StarFire RTK 900 MHz Radio

OPERATOR'S MANUAL

StarFire RTK 900 MHz Radio

OMPFP11348 ISSUE L1 (ENGLISH)

CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

If this product contains a gasoline engine:

⚠ WARNING

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

The State of California requires the above two warnings.

Additional Proposition 65 Warnings can be found in this manual.

Deere & Company
North American Version
PRINTED IN THE U.S.A.

Introduction

www.StellarSupport.com

NOTE: Product functionality may not be fully represented in this document due to product changes occurring after the time of printing. Read the latest Operator's Manual and Quick Reference Guide prior to operation. To obtain a copy, see your dealer or visit www.StellarSupport.com

OUO6050,00012A7 -19-31AUG10-1/1

Contents

Original Instructions. All information, illustrations and specifications in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

Recognize Safety Information

This is a safety-alert symbol. When you see this symbol on your machine or in this manual, be alert to the potential for personal injury.

Follow recommended precautions and safe operating practices.

T81389 —UN—07DEC88

DX,ALERT -19-29SEP98-1/1

Understand Signal Words

A signal word—DANGER, WARNING, or CAUTION—is used with the safety-alert symbol. DANGER identifies the most serious hazards.

DANGER or WARNING safety signs are located near specific hazards. General precautions are listed on CAUTION safety signs. CAUTION also calls attention to safety messages in this manual.

TS187 —19—30SEP88

DX,SIGNAL -19-03MAR93-1/1

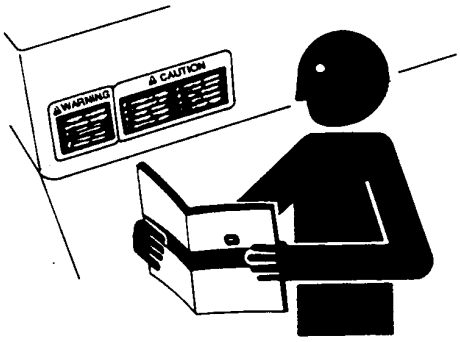
Follow Safety Instructions

Carefully read all safety messages in this manual and on your machine safety signs. Keep safety signs in good condition. Replace missing or damaged safety signs. Be sure new equipment components and repair parts include the current safety signs. Replacement safety signs are available from your John Deere dealer.

There can be additional safety information contained on parts and components sourced from suppliers that is not reproduced in this operator's manual.

Learn how to operate the machine and how to use controls properly. Do not let anyone operate without instruction.

Keep your machine in proper working condition. Unauthorized modifications to the machine may impair the function and/or safety and affect machine life.



TS201 —UN—23AUG88

If you do not understand any part of this manual and need assistance, contact your John Deere dealer.

DX,READ -19-16JUN09-1/1

Practice Safe Maintenance

Understand service procedure before doing work. Keep area clean and dry.

Never lubricate, service, or adjust machine while it is moving. Keep hands, feet , and clothing from power-driven parts. Disengage all power and operate controls to relieve pressure. Lower equipment to the ground. Stop the engine. Remove the key. Allow machine to cool.

Securely support any machine elements that must be raised for service work.

Keep all parts in good condition and properly installed. Fix damage immediately. Replace worn or broken parts. Remove any buildup of grease, oil, or debris.

On self-propelled equipment, disconnect battery ground cable (-) before making adjustments on electrical systems or welding on machine.

On towed implements, disconnect wiring harnesses from tractor before servicing electrical system components or welding on machine.

TS218 —UN—23AUG88

DX,SERV -19-17FEB99-1/1

Handle Electronic Components and Brackets Safely

Falling while installing or removing electronic components mounted on equipment can cause serious injury. Use a ladder or platform to easily reach each mounting location. Use sturdy and secure footholds and handholds. Do not install or remove components in wet or icy conditions.

If installing or servicing a RTK base station on a tower or other tall structure, use a certified climber.

If installing or servicing a global positioning receiver mast used on an implement, use proper lifting techniques and wear proper protective equipment. The mast is heavy and can be awkward to handle. Two people are required when mounting locations are not accessible from the ground or from a service platform.

TS249 —UN—23AUG88

DX,WW,RECEIVER -19-24AUG10-1/1

Prevent Electrical Shock and Fires

To prevent injury from electrical shock, always disconnect power to the receiver, antenna, and amplifier before installing or servicing.

To prevent injury from electrical shock, always disconnect power to the receiver and radio equipment before installing or servicing.

Understand and follow all local codes and regulations when installing electrical equipment.

PC12631 —UN—04JUN10

DK01672,0000207 -19-30NOV11-1/1

FCC NOTIFICATIONS TO USER

FCC NOTIFICATION

These devices comply with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. These devices may not cause harmful interference.
2. These devices must accept any interference received, including interference that may cause undesired operation.

These devices must be operated as supplied by John Deere Ag Management Solutions. Any changes or modifications made to these devices without the express written approval of John Deere Ag Management Solutions may void the user's authority to operate these devices.

DK01672,0000182 -19-29AUG11-1/1

900 MHz RTK

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, no guarantee shall be made that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

JS56696,000082A -19-26APR10-1/1

900 MHz RTK Power source

- A Base Station should have a continuous 12V power source such as an AC/DC converter to power the base station.

NOTE: The AC/DC converter is NOT supplied by John Deere.

- *A battery backup is recommended to keep the base station running in the case of power outages for dependable operation.*

DK01672,00001E0 -19-15NOV11-1/1

System Overview

The StarFire™ RTK system consists of a local base station placed in a field or mounted on a structure that transmits high accuracy corrections to the vehicle StarFire receiver using RTK radios. The StarFire receiver on the RTK-equipped vehicle must have a direct line of sight with the base station in order to receive the RTK signal.

Performance of the RTK system is related to the operating distance from the base station. When operating beyond 20 km (12 miles), degraded accuracy will occur and it may take longer to initially acquire the RTK signal.

A repeater, which is simply an RTK radio supplied with 12 volts of power, can be used to receive the base station signal and establish a new line of sight point. However, performance limitations can still be expected if trying to use the repeater to transmit the RTK signal to a vehicle that is farther than 20 km (12 miles) away from the base station.

NOTE: Old antennas from past receivers are not compatible with the StarFire 3000 receiver.

Receiver—On Vehicle

Position receiver with integrated RTK radio module is located on top of machine. Position receiver receives global positioning and differential correction signal through a single receiver and integrates signal for use with system.

The receiver has a dedicated operating mode (Vehicle Mode). Refer to “Operating Mode—RTK” in “StarFire 3000” Section for setup of the receiver on vehicle.

IMPORTANT: The antenna must be installed before the radio module is powered ON.

Avoid water intrusion by keeping the antenna attached whenever possible.

PC12123 —UN—11JUN09

Removing the antenna while transmitting may damage the radio module.

NOTE: Actual receiver position may vary with the use of an Original Shroud or Deluxe Shroud bracket.

Continued on next page

JS56696,00007FF -19-15APR10-1/3

Receiver—On Base Station

The base station is the most critical part of an RTK system. During installation, care must be taken to ensure the base has problem-free operation. There are two issues that are responsible for most problems with a base station: **Shading and Multipathing**. If a base station experiences one of these problems, it could be detrimental to your RTK operation. Although it may not be possible to locate a base station in an ideal location, this guide is aimed at helping to define the best option available.

Base station operating mode can be either Absolute Survey Base Mode or Quick survey Base Mode. Refer to “Operating Mode—RTK” in “StarFire 3000” Section for setup of the receiver on base station.

Refer to “Base Station Operation and Setup” in “StarFire 3000” Section for proper use and setup of the base station.

PC12108 —UN—03JUN09

Continued on next page

JS56696,00007FF -19-15APR10-2/3

Repeater Radio

The radio can be configured to act separately as a repeater. A repeater is required if obstructions (i.e. trees, hills, etc.) exist between the base station and vehicle(s) or if base station is too far away from the vehicles.

A repeater consists of:

- Radio (configured as a repeater)
- Harness
- Mounting Bracket
- 12 Volt Power Source
- Tripod or wall mount cradle

IMPORTANT: A repeater can only be used to repeat a signal from a base station to a vehicle. Therefore, a repeater cannot be used in a "daisy chain," repeating the signal from one repeater to another.

Refer to “Repeater—RTK” in “StarFire 3000” Section to properly configure radio as repeater.

ZX1038656 —UN—06FEB06

JS56696,00007FF -19-15APR10-3/3

Installation of the RTK radio and antenna

After installing the base station receiver, installing the radio in a location to best maximize the output can be a challenge. Below are four options currently available through John Deere.

- Leave the RTK radio in its original configuration attached directly behind the base station receiver.
  - Use a repeater as part of the base station. Install a radio with the base station receiver.
  - Install a Repeater radio (available through whole goods or parts) in an elevated location.
- The base station will then send the RTK data to the repeater and the repeater will then transmit that data out to the repeater , and vehicle on the network. This will eliminate other repeaters in the system.

  NOTE: Additional repeaters cannot be run off of the central repeater. In areas with heavy foliage or uneven terrain, this setup method is not advised.

- Use 92 m (300 ft) extension harness PF80821 to move the radio from the back of the base station receiver to an elevated position.

  NOTE: Use extension harness PF80821.

  Use installation instructions provided with extension harness PF80821 to ensure proper grounding and wiring according to the installation instructions. This harness has built in protection for both the radio and receiver for unwanted static electricity developed on the harness.

- Attach the RTK radio in a safe and unobstructed location, Connect radio and antenna using coaxial cable.

  IMPORTANT: The antenna must be installed before the radio module is powered ON.

  Avoid water intrusion by keeping the antenna attached to the radio whenever possible.

  Removing the antenna while transmitting may damage the radio module.

  IMPORTANT: If using a coaxial cable between the radio and antenna, use the lowest-loss cable available to avoid RTK radio link range issues.

  NOTE: When using this option, it may be necessary to install a higher-gain antenna to compensate for loss.

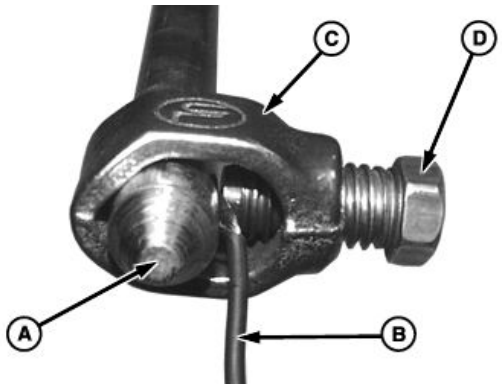
  NOTE: Old antennas from past receivers are not compatible with the StarFire 3000 receiver.

Always mount the radio antenna vertically to make sure that the RTK signal is radiating outwards. If the antenna is at an angle, it may cause the data received at the vehicle to be lower than expected.

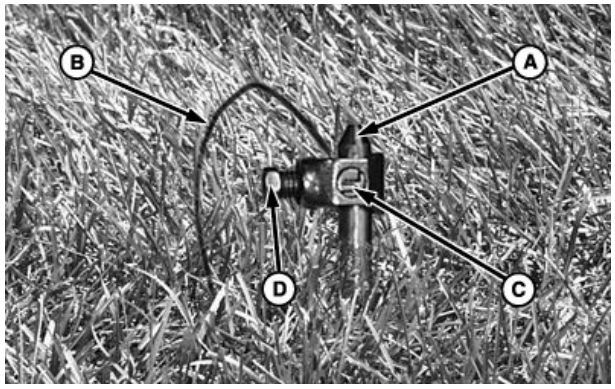
DK01672,0000208 -19-01DEC11-1/1

Attaching RTK Harness

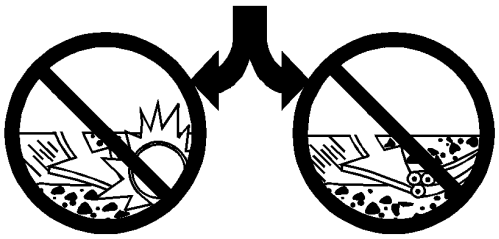
PC8570 —UN—14JUL05



PC8568 —UN—14JUL05



PC8571 —UN—14JUL05



PC8569 —UN—14JUL05

A—Rod **B—Grounding Wire** **C—Collar** **D—Screw**

CAUTION: Avoid serious injury or death to you or others. Contact your local utility companies to determine the location of gas, electric, or water lines. Placement of grounding rod must be a safe distance away from pipelines and cables.

IMPORTANT: Carefully choose location of rod so that it is away from paths where it could damage equipment or be damaged by equipment.

DO NOT route RTK Extension harness along any other power sources. Keep harness at least 2m (6 ft) away from any other AC power lines.

1. Attach harness between radio and receiver.
2. Carefully determine placement of rod (A) a safe distance away from pipelines and cables. Drive into ground leaving one end above surface.
3. Route grounding wire (B) from harness to rod. Grounding wire may be extended if necessary to reach rod.
4. Remove insulation from end of grounding wire.
5. Place collar (C) over end of rod.
6. Place grounding wire between rod and screw (D).
7. Tighten screw.
8. Restrain harness to supporting structures as necessary to keep them away from equipment, damage, and to reduce wire strain.

JS56696,0000801 -19-15APR10-1/1

RTK Network Base Station Setup

A—5 Degrees Off the Horizon (Mask)

Installing and operation of the Base Station Receiver.

The base station is the most critical part of the RTK operation. Setting up a base station correctly is vital to the operation of the RTK system. If the Base Station Receiver is setup in a questionable location, the receiver could have two separate issues; Shading and Multipathing.

Shading:

To ensure proper operation of a RTK base station, the GPS Receiver must have a clear view of the sky in all directions above 5 degrees off the horizon. Both the base receiver and the vehicle receiver will use any satellites that are above 5 degrees off the horizon. If a base station receiver cannot use a satellite above 5 degrees, then all vehicles operating on that base station also cannot use that blocked satellite. This is called Shading of the base station. If enough shading occurs, the RTK system may become inaccurate. Many things can cause shading, such as buildings, towers, poles, and grain legs.

Continued on next page

DK01672,0000209 -19-01DEC11-1/3

When selecting a base station location, there are three main points to look for: rigidity, good view of the sky, and few reflective objects. The base station provides corrections to the vehicle receiver based on the fixed known position which is surveyed in with an absolute survey or quick survey. Any motion of the base station receiver will translate directly to the vehicle position. Mount the base station on a rigid structure, such as the pole in the photo. When mounting on a structure such as a building, the receiver should generally be installed 2 meters above the highest point.

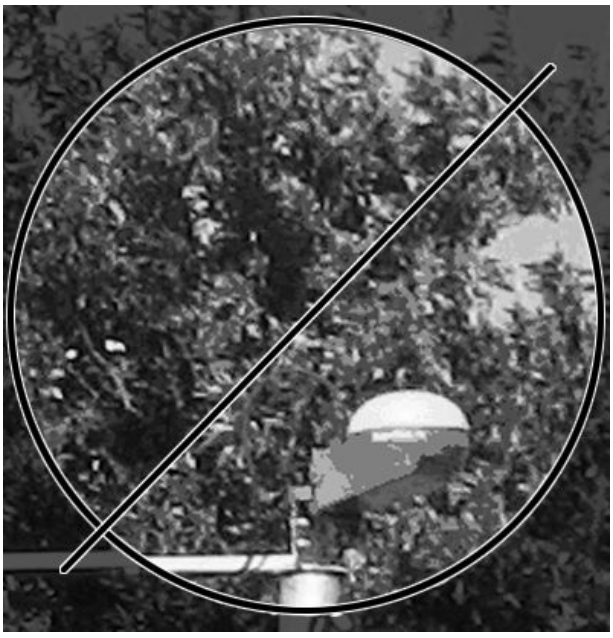
PC12104 —UN—03JUN09

Receiver on Rigid Pole

DK01672,0000209 -19-01DEC11-2/3

PC12105 —UN—03JUN09

Receiver on Radio Tower



PC12106 —UN—03JUN09

Receiver Next to Trees

Since GPS satellites orbit the earth, the base station needs to have a clear view of the sky in all directions above a 5 degree mask angle. Base stations with a good view of the sky are much more reliable than those with shading. Installing the receiver on the side of radio towers or next to trees is not recommended.

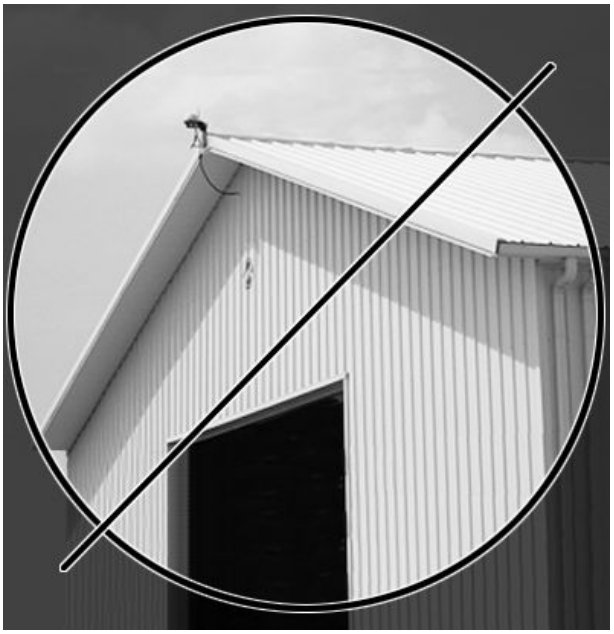
DK01672,0000209 -19-01DEC11-3/3

Multipathing

Signal reflections are another important error source for base stations that should be minimized. Reflected signals also reach the base station receiver and make the satellite range measurement longer. Reflections can even interfere with the direct signal enough so that the receiver will temporarily lose lock on the satellite. Metal buildings, chain-link fences, and bodies of water are all good reflectors that can make a base station less reliable. Take care to place your base station receiver far away from strong reflectors for reliable base station operation.

A base station should have a continuous 12V power source such as an AC/DC converter to power the base station. A battery back-up is recommended to keep the base station running in the case of power outages for dependable operation.

NOTE: The AC/DC converter is not supplied by John Deere.

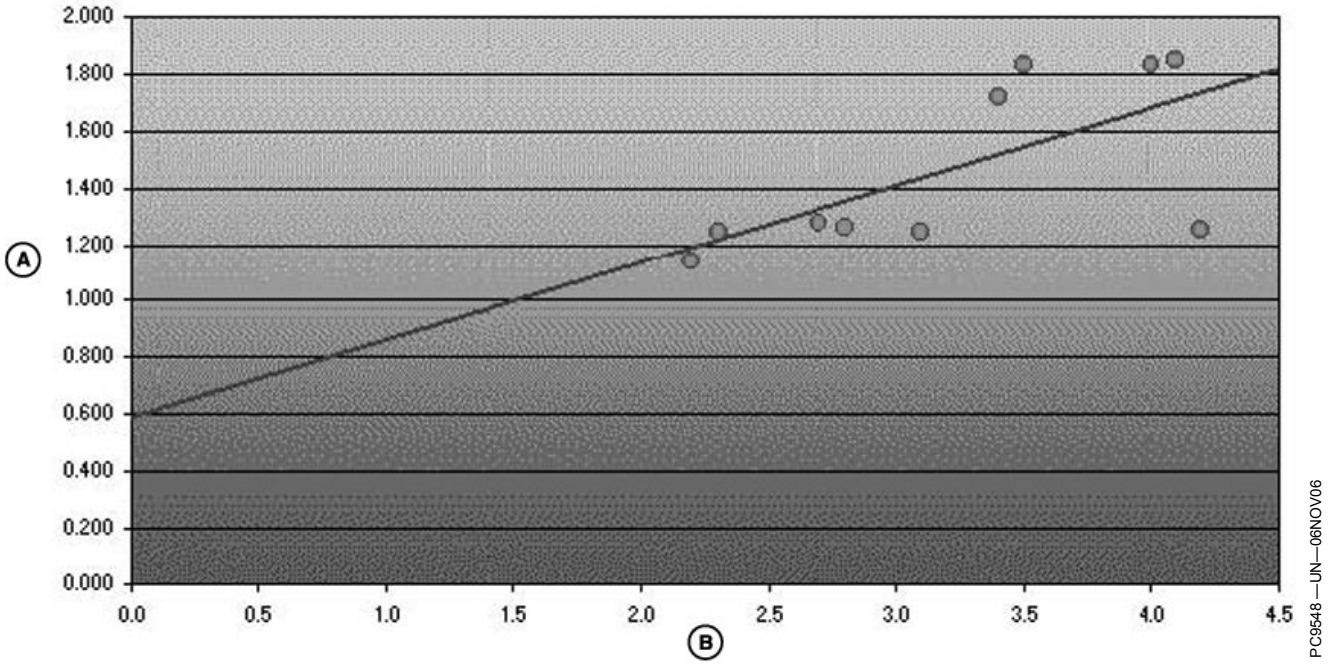


PC12107 —UN—03JUN09

Reflection off Metal Building

DK01672,00001C2 -19-11NOV11-1/1

PDOP Definition



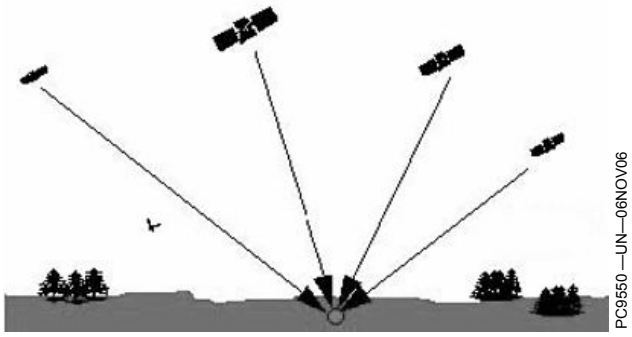
A—Horizontal Precision (m) **B—Maximum PDOP Value**

The Position Dilution of Precision (PDOP) is likely one of the most critical GPS AutoTrac values to monitor. As the PDOP value increases, both the horizontal and vertical precision (guidance accuracy) of your data points decreases.

To help illustrate this relationship, please review the graph, which plots the PDOP value against the horizontal precision points collected on and around the University of Montana campus. Ten locations were collected to serve as ground control points to register an April 4, 1999 aerial photograph of the University area. You can see that as the PDOP value climbs from a minimum of 1.15 to a maximum of approximately 4.5, the horizontal precision and accuracy decreases from about 1.15 meters to about 1.9 meters. PDOP values below 7 are generally required to collect data at a 1 meter accuracy range (as determined by the PDOP mask set on your data logger) and any value below 3.5 is considered in-range for AutoTrac applications.

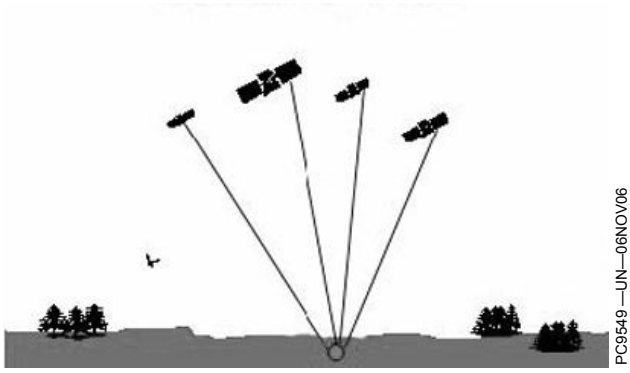
Continued on next page

DK01672,00001E2 -19-15NOV11-1/2



GOOD

Keep in mind that PDOP (Position Dilution of Precision) is the measure of the geometrical strength of the GPS satellite configuration. As a general rule, any PDOP value below 3.5 is acceptable to use while operating AutoTrac but, the lower the number, the more precise the steering accuracy will be.

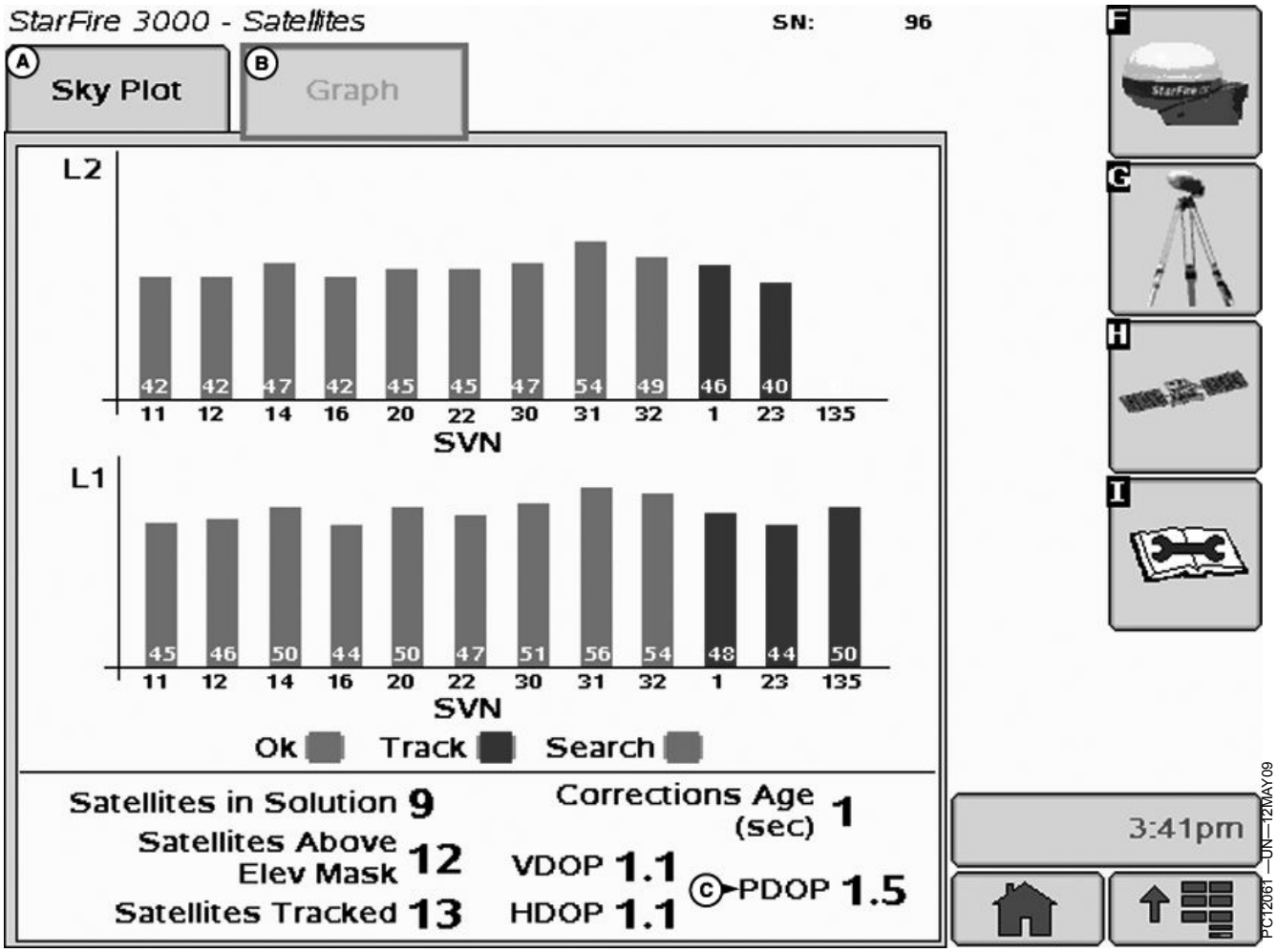


BAD

During vehicle operation, the PDOP can be viewed under the StarFire information pages in both the Original GreenStar Display, 2600 Display, and 2630 Display.

DK01672,00001E2 -19-15NOV11-2/2

PDOP Operating Values



StarFire 3000 - Satellites

A—SkyPlot tab **B—Graph tab** **C—PDOP**

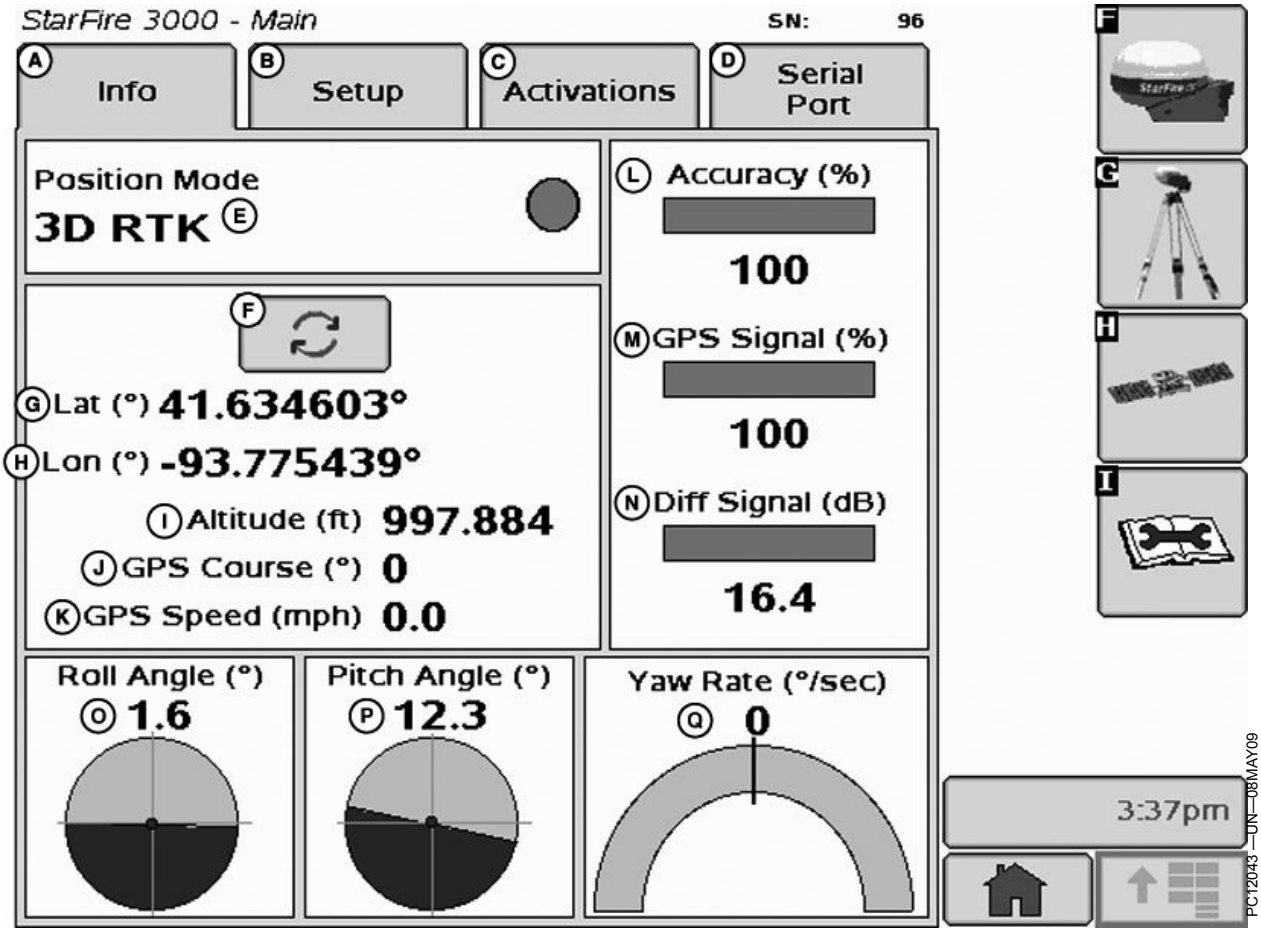
PDOP operating values should remain BELOW 3.5 DURING ALL AUTOTRAC OPERATIONS, especially RTK high precision operations. As the value of PDOP rises above 3.5, position accuracy will be compromised.

As a rule, when the GPS receiver is warming up from being in a powered off state and gathering satellite signals high PDOP values (4 to 20+) will be experienced for upwards of 15 minutes (under normal conditions).

It is important to monitor PDOP along with GPS signal quality while performing field operations.

JS56696,0000805 -19-15APR10-1/1

StarFire Signal Monitoring System

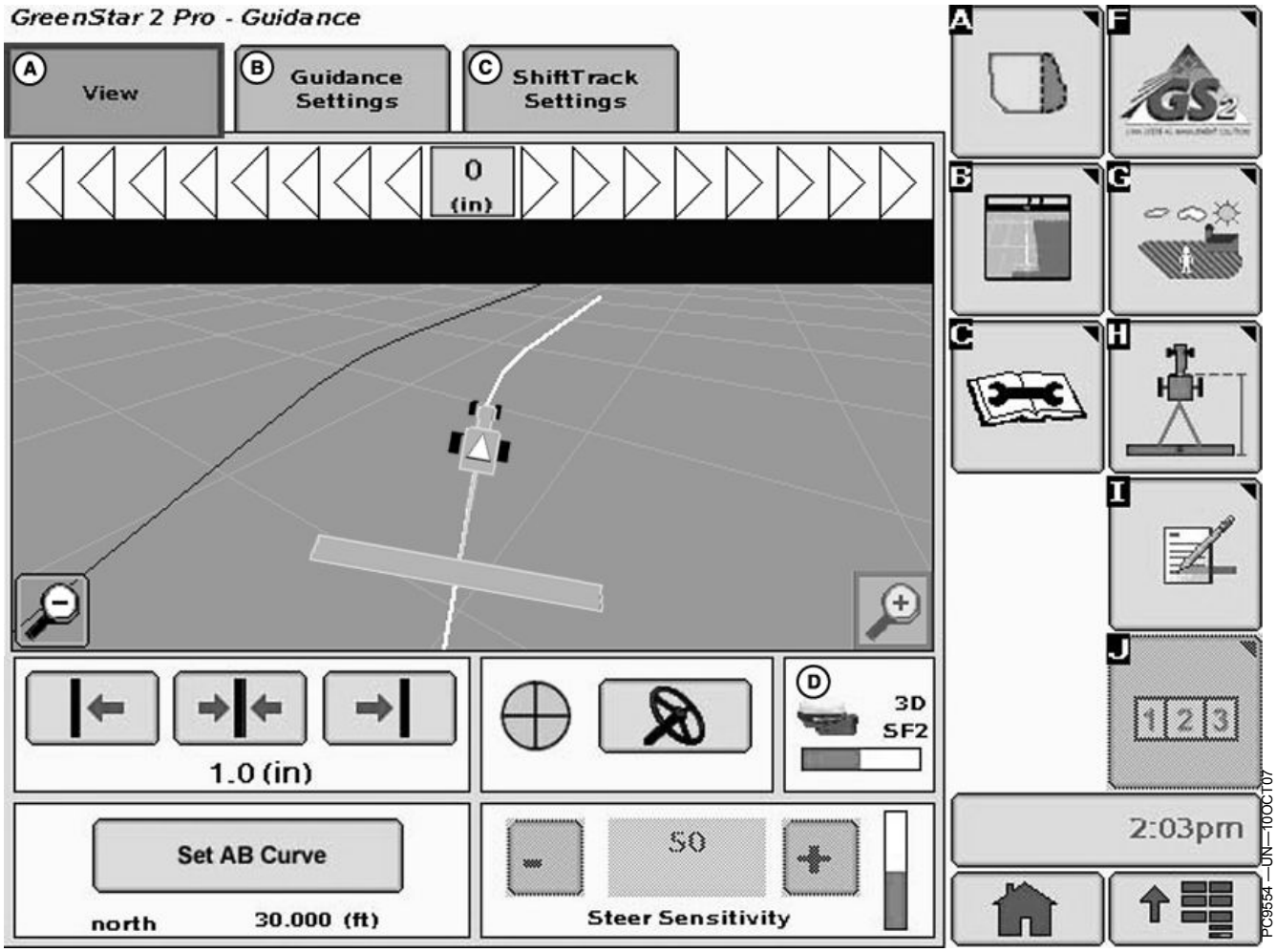


StarFire 3000 Main

A—Info tab
B—Setup tab
C—Activations tab
D—Serial Port tab
E—Position Mode
F—Degrees/Minutes/Seconds to Decimal Toggle
G—Latitude
H—Longitude
I— Altitude
J—GPS Course
K—GPS Speed
L—Accuracy
M—GPS Signal
N—Differential Signal
O—Roll Angle
P—Pitch Angle
Q—Yaw Rate

Continued on next page

JS56696,0000806 -19-15APR10-1/5



GreenStar2 Pro - Guidance

A—View **B—Guidance Settings** **C—ShiftTrack Settings** **D—Signal Quality**

The GS2 alerts the operator when the current StarFire signal is not accurate. There are three levels of this alarm system (Normal, Marginal, and Poor). The levels are determined both by the StarFire Receiver's PDOP value and the number of satellites being tracked. It is recommend that if the StarFire receiver is being used in high accuracy operations that care be taken when the StarFire Signal Monitoring system indicates that the current status is Marginal or Poor, as accuracy degradation may occur.

NOTE: Operating in RTK or RTK-X, both PDOP and "Number of Satellites" are used to determine the level of alarm.

Operating at a signal level less than RTK (SF2, SF1, WAAS, ect.) only PDOP will be used to determine the level of alarm.

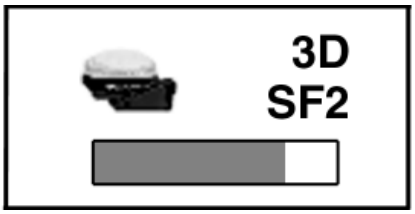
Continued on next page

JS56696,0000806 -19-15APR10-2/5

Normal

- Green Bar
- Normal Operating Range
- Acceptable range for high accuracy operations
- PDOP value: 0 - 3.5
- 6 or more satellites in solution

PC9387 —UN—17OCT06



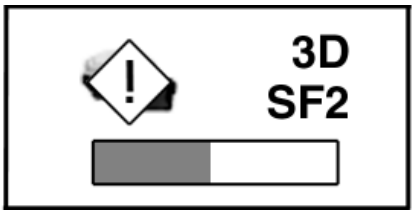
Normal

JS56696,0000806 -19-15APR10-3/5

Marginal

- Orange bar with permanent operator alert sign
- Marginal operating range
- Moderate risk of accuracy degradation
- PDOP value: 3.5 - 4.5
- 5 satellites in solution

PC9388 —UN—17OCT07



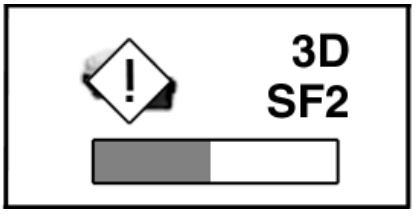
Marginal

JS56696,0000806 -19-15APR10-4/5

Poor

- Red bar and flashing operator alert sign
- Poor operating range
- Significant risk of accuracy degradation - high accuracy operations are not advised
- PDOP value greater than 4.6
- 4 satellites or less in solution

PC9388 —UN—17OCT07



Poor

JS56696,0000806 -19-15APR10-5/5

Antenna Height

RTK Shared Base Station: Antenna Height

In order to maintain a good RTK Radio link, the antenna must be mounted high enough to radiate over the earth's curvature and any obstacles. As shown in the figure, the curve of the earth can block the signal from the RTK link. If the radiating base station radio antenna is mounted too low, the broadcasting range will be drastically reduced.

PC9393 —UN—23OCT06

JS56696,0000807 -19-15APR10-1/1

Specific Tower Setup Information

It is recommended that the receiver be, at minimum, 9.1 m (30 ft) away from the tower to prevent both Shading and Multipathing. This distance may vary depending on the frame design of the tower or structure that you are mounting it around.

When using the 91 m (300 ft) extension harness, do not cut the harness to the length needed. This harness has built in voltage protection and is shielded. Cutting the harness will limit the effectiveness of the harness and will cause failures of either the radio or the receiver due to static electricity build up on the harness. This harness was built to be buried underground, so it is suggested to bury all extra harness underground to protect the harness.

After deciding what structure that you will be mounting your base station on, there are five different ways to set up your base station.

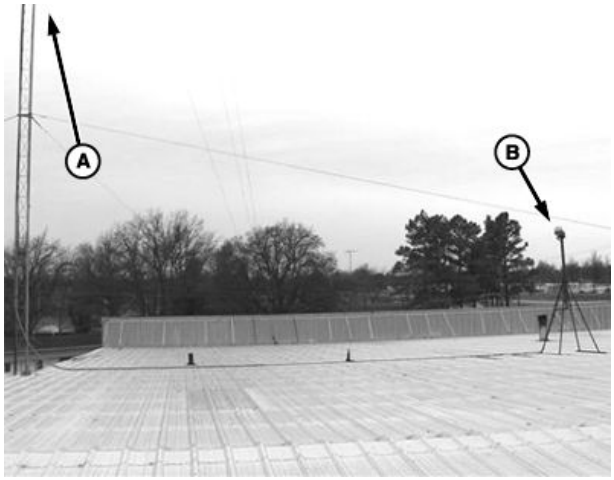
- Utilizing Both The 91 m (300 ft) RTK Extension Harness And Low Loss Coax Cable
- Utilizing The RTK Extension Harness
- Utilizing A Repeater
- Utilizing Just Low Loss Coax Cable
- Leaving The Radio And Receiver As A Single Unit

JS56696,0000808 -19-15APR10-1/1

Utilizing The RTK Extension Harness

This base station setup allows you to mount the receiver at a secure location and mounting the radio, with antenna, to an elevated position, and utilizing 91 m (300 ft) of RS232 cable between the receiver and radio.

A—Radio mounted on tower **B—Base Station Receiver**



PC8762 —UN—16SEP05

JS56696,000080A -19-15APR10-1/1

Utilizing Just Low Loss Coax Cable

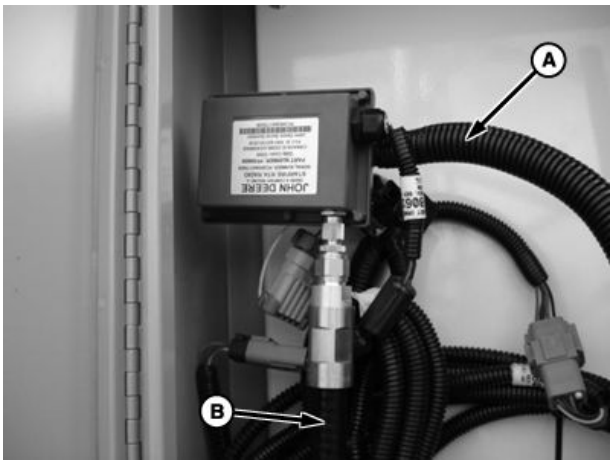
This base station set up leaves the receiver and radio in a secure location and using low loss coax cable running to the antenna at an elevated position.

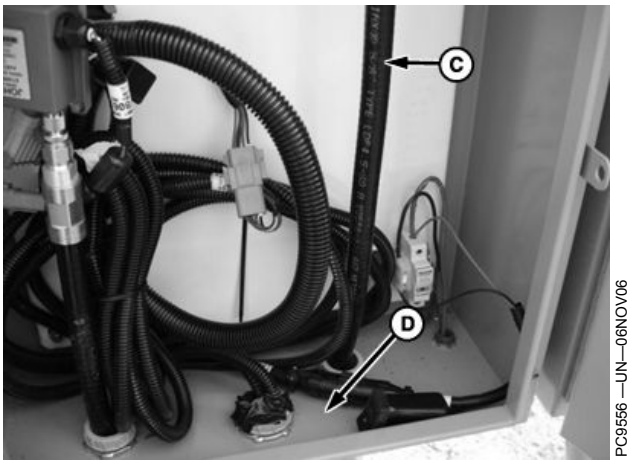
A—Receiver and Radio **B—Coax Cable**

PC8763 —UN—16SEP05

JS56696,000080C -19-15APR10-1/1

Utilizing Both The 91 m (300 ft) RTK Extension Harness And Low Loss Coax Cable





A—91.4 m (300 ft) RS232 Cable from receiver

B—Coax cable connection from antenna

C—Coax running up tower to antenna

D—Coax looped under electrical box

This base station setup allows the placement of the receiver to be up to 91.4 m (300 ft) away from the radio, giving the base station an absolute clear view of the sky.

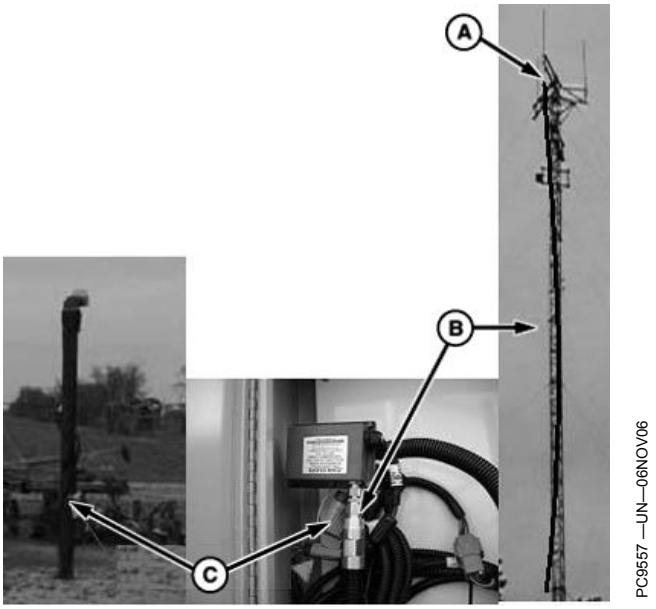
JS56696,0000809 -19-15APR10-1/2

The radio, usually installed in a secure location at the bottom of a tower, is then connected to low loss coax that is ran up the tower to the antenna.

A—Antenna

B—Low-Loss Coax Cable

C—91.4 m (300 ft) RS232 Cable



JS56696,0000809 -19-15APR10-2/2

Utilizing A Repeater

This base station setup allows the placement of the receiver and radio in a location with no obstructions. A repeater, with its own power source, is placed at an elevated location. The base station radio sends its signal up to the repeater and the repeater then sends out the signal.

NOTE: With this type of base station setup, no other repeaters can be used with the base station.

PC8761 —UN—16SEP05

JS56696,000080B -19-15APR10-1/1

Leaving The Radio And Receiver As A Single Unit

This base station setup keeps the receiver and radio as a single unit usually mounted in an elevated location.

IMPORTANT: Receiver must have a clear view of the sky and must be free of Multipathing.

The receiver must not move. Any movement of the receiver will result in movement of the vehicle receivers.

PC9558 —UN—06NOV06

JS56696,000080D -19-15APR10-1/1

RTK softkey

Allows for setup and display of RTK information

- Operating Mode
- RTK Network Configuration
- Base Station Data
- Radio Data

RTK can be operated in six modes

- OFF
- Vehicle
- Vehicle Repeater
- Repeater
- Quick Survey Base
- Absolute Base

IMPORTANT: Anytime the radio is disconnected, power must be cycled at the GPS receiver before continuing.

Vehicle Mode Select for receiver on vehicle.

Vehicle Repeater Mode Allows for the vehicle to accept and repeat RTK corrections.

Repeater Mode A repeater is required if obstructions (i.e trees, hill, etc.) exist between base station and vehicle(s).

Quick Survey Base Mode Select Quick Survey Base Mode if exact location of guidance tracks will not be used for future applications. If Quick Survey Base Mode is used to establish rows or paths used at a later date, location or Track 0 must be stored using Current Track 0 in Guidance Setup – Set Track 0. When Track 0 is recalled, a one-time use of Shift Track feature is needed to align vehicle on previous tracks. See Setup Quick Survey Base Mode section.

NOTE: Quick Survey Base Mode requires a 15 minute self survey to be conducted on location before first use.

Absolute Survey Base Mode Select Absolute Survey Base Mode if exact location of guidance tracks need to be stored for future guidance applications without relying on visual reference for track position to align using Shift Track feature. Track 0 must be stored using Current Track 0 in Guidance Setup – Set Track 0 in order to follow previously used tracks. Absolute Base Mode requires 24-hour self survey to be conducted on location before first use. After survey is completed, base station will then transmit corrections. If base station is moved to another position and then returned to original surveyed position, it is important that base station is mounted in exact same position. Any difference between original surveyed position and mounted position will result in offset

PC8663 —UN—05AUG05

MENU button

PC12042 —UN—08MAY09

StarFire 3000 button

PC8681 —UN—05AUG05

RTK softkey

of corrected position. For this reason, it is important to mount receiver to a fixed position like a building or post mounted in concrete.

OFF Mode This mode disables all RTK functionality in receiver. RTK Operating Mode must be OFF for normal SF1 or SF2 operation on SF2-licensed receiver.

NOTE: Radio can be configured to act separately as repeater. A repeater is required if obstructions (i.e. trees, hills, etc) exist between base station and vehicle(s).

A repeater consists of:

- Radio (configured as a repeater)
- Harness
- Mounting Bracket
- 12 volt Power Source

To configure radio as repeater:

Select: MENU button >> StarFire 3000 button >> RTK softkey

Select RTK Operating Mode (Vehicle, Quick Survey Base or Absolute Base).

NOTE: A radio can be configured as a repeater from any RTK Operating Mode.

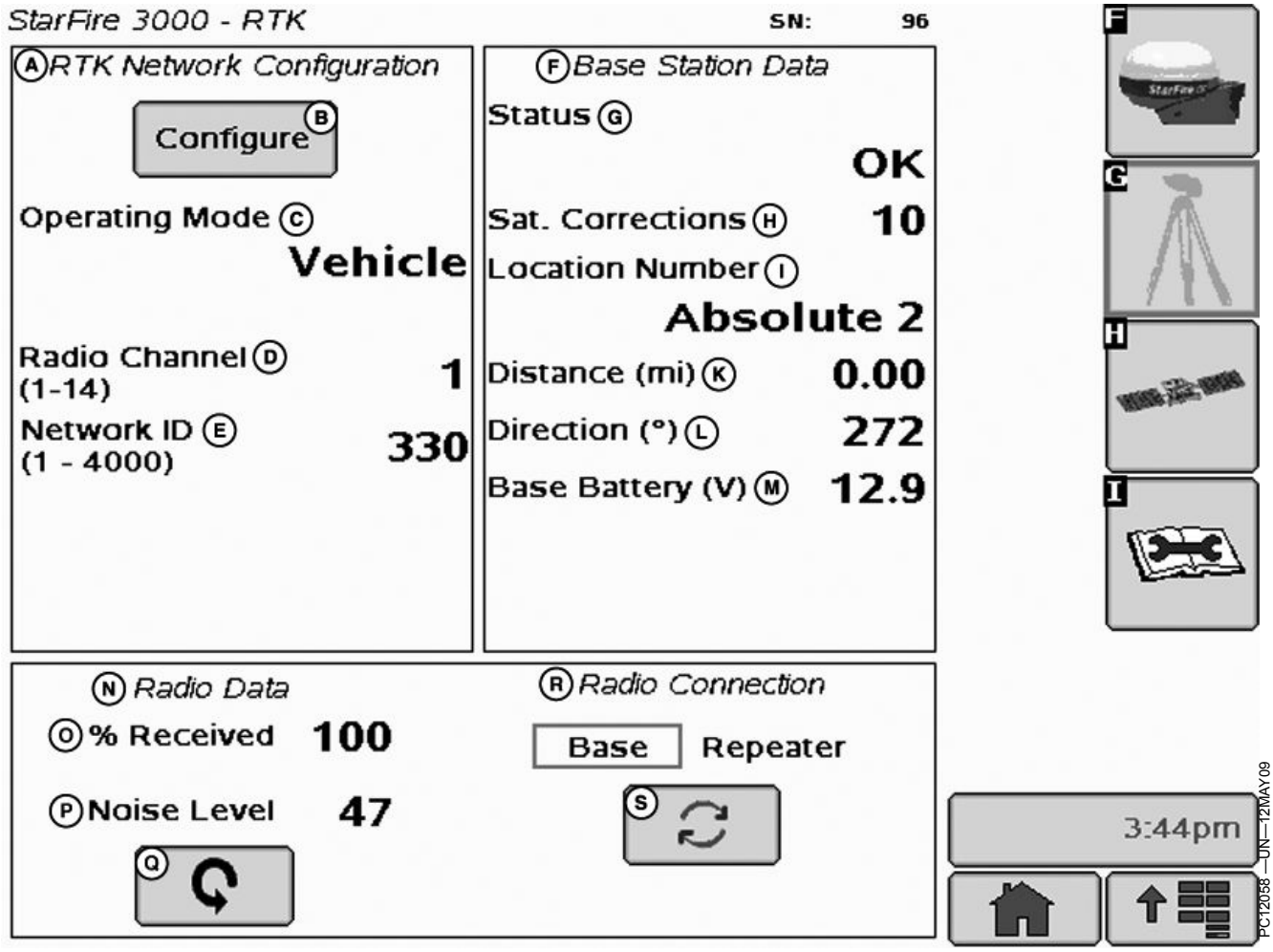
1. Disconnect original radio from receiver.
2. Connect radio to be configured to receiver RTK harness.
3. Check that the radio serial number and software version are displayed.

Continued on next page

4. Check that base station, vehicle, and repeater have same Frequency, Network ID and Radio Channel.
5. Select START button located under Configure Repeater Radio.
6. Radio will configure as repeater.
7. Disconnect repeater radio from receiver and wiring harness.
8. Reconnect original radio.

DK01672,00001C1 -19-11NOV11-2/2

Vehicle



StarFire - RTK

A—RTK Network Configuration
B—Configure button
C—Operating Mode
D—Radio Channel
E—Network ID
F—Base Station Data
G—Status
H—Satellite Corrections
I— Location Number
K—Distance
L—Direction (degrees)
M—Base Battery (V)
N—Radio Data
O—Percent Received
P—Noise Level
Q—Refresh button
R—Radio Connection
S—Radio Connection Toggle button

IMPORTANT: Base station receiver and vehicle receiver must be setup before operating RTK. See RTK Setup sections.

Select: MENU button >> StarFire 3000 button >> RTK softkey >> CONFIGURE button >> OPERATING MODE drop down box >> VEHICLE

When vehicle receiver is powered-up, No GPS, No Diff will be displayed on Guidance View or home page screen until an initial position is determined. When base station transmits correction signal, 3D RTK will be displayed.

NOTE: If communication loss occurs WITHIN first hour of base station operation, Extend Mode will provide RTK accuracy for two minutes.

If Communication loss occurs AFTER first hour of base station operation, Extend Mode will provide RTK accuracy for 15 minutes.

Extend Mode (RTK-X) If communication between base station and vehicle radio is lost for more than 10 seconds, vehicle receiver will automatically switch to Extend Mode and will maintain RTK accuracy for a period of time. If the base station has been navigating in SF2 for less than 1 hour, the RTK-X timeout can vary from 2 minutes to 15 minutes depending on the accuracy of the base station's SF2 solution. As the base station solution pulls in, more RTK-X time will be allowed. After the base station has been navigating in SF2 mode for 1 hour, the vehicle receiver will have 15 minutes of RTK-X after the radio communication is lost. If base station communication is not re-established after Extend period, receiver will default to WAAS in North America, or NO DIFF where WAAS is not available. To re-establish communication, move vehicle to a location where line of sight to base station can be established.

Continued on next page

DK01672,00001BE -19-11NOV11-1/2

Base Station Data (Information)

Operator can view the following:

Base Station Data in information that will be displayed when in Quick survey Base or Absolute Base Mode.

- Status
  - OK—Base Station is transmitting correction.
  - No Stored Base—24 hour self survey is required for current location.
  - Initializing—Receiver is initializing radio, acquiring GPS signal.
  - Self Survey—24 hour self survey in progress.
- Sat. Corrections – Indicates number of GPS satellites for which base station is transmitting correction.
- Distance – Difference between base station location (known position) and location indicated by uncorrected GPS. Displayed in miles (kilometers).
- Direction – Direction from base station location (known position) to location indicated by uncorrected GPS. Displayed in degrees with true North as 0 degrees.
- Base Battery – Base Station voltage. Displayed in volts.

Radio Data and Connection

Signal Level – Level of signal which is detected at radio. Select Refresh button to refresh signal level.

Vehicle Mode – Base Station Data

NOTE: Information that will be displayed when in Vehicle Mode.

- Status
  - OK – Base Station is transmitting correction.
  - No Stored Base – 24 hour self survey is required for current location.
  - Initializing – Receiver is initializing radio, acquiring GPS signal.
  - Self Survey – 24 hour self survey in progress.
  - No Signal – Vehicle RTK radio is not receiving signal from base station.
- Sat. Corrections – Indicates number of GPS satellites for which base station is transmitting correction.
- Distance – Difference from base station to vehicle receiver. Displayed in miles (kilometers).
- Direction – Direction in degrees to base station. Displayed in degrees with true North as 0 degrees.
- Base Battery – Base Station voltage. Displayed in volts.

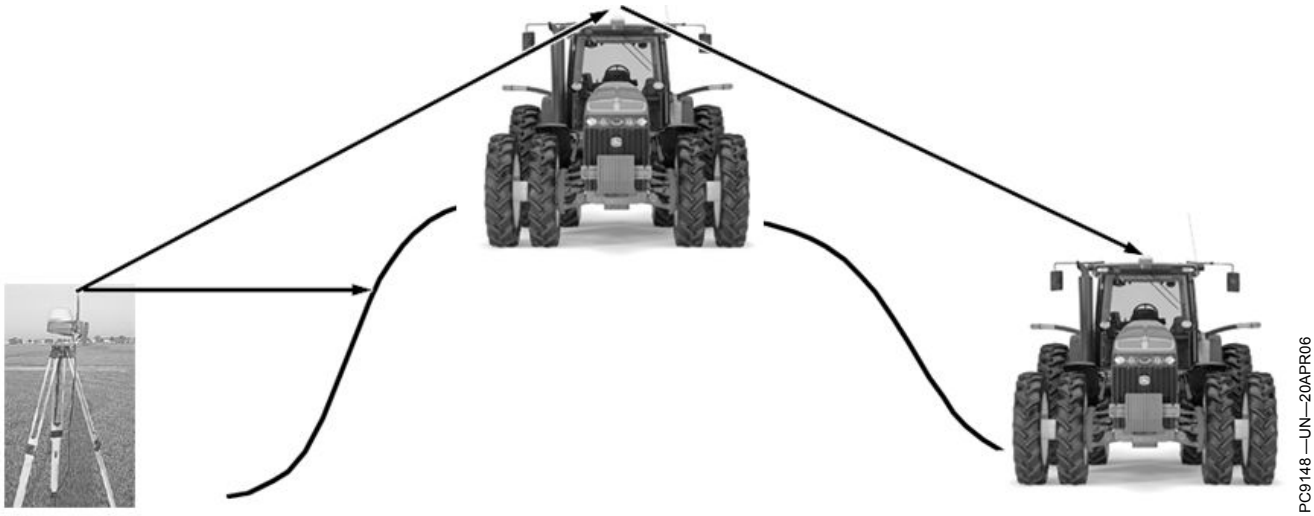
Radio Data and Connection

- Signal Level – Level of signal which is detected at radio. Press Refresh button to refresh signal level.
- Data Received (%) – Percent of received correction to vehicle from base station.

Indicates source of correction. If there is no correction, this will toggle between base and repeater. There is also a TOGGLE button for manual toggle between two sources.

DK01672,00001BE -19-11NOV11-2/2

Vehicle Repeater



Press: MENU button >> StarFire 3000 button >> RTK Softkey

Select “Vehicle Repeater” from Operating Mode list box.

In this mode the RTK vehicle radio not only receives messages but also rebroadcasts them (similar to a RTK repeater) to other RTK vehicles in close proximity.

NOTE: Vehicle Repeater is identical to the Vehicle mode with the addition of having the radio rebroadcast the RTK messages.

The Vehicle Repeater mode allows an RTK vehicle to function normally as an RTK vehicle while also transmitting the base correction signal to another RTK vehicle that does not have line-of-sight to the base station.

The ‘Vehicle Repeater’ needs to be between the base station and the ‘Vehicle’. The ‘Vehicle Repeater’ must be able to communicate with the base station. The ‘Vehicle’ must then have either line of sight communication to the base station or ‘Vehicle Repeater’.

IMPORTANT: There should be only ONE Vehicle Repeater or Repeater in the same vicinity with the same Network ID.

JS56696,00007ED -19-15APR10-1/1

Quick Survey Mode

NOTE: Display is not required after base station receiver has been configured to operate in Quick Survey Mode and RTK Radio Frequency, Network ID and Radio Channel have been set.

Connect display to base station.

Press: MENU button >> StarFire 3000 button >> RTK softkey

Select Quick Survey Base from Operating Mode list box.

NOTE: Quick Survey Base Mode allows base station to broadcast corrections after receiver calculates GPS position.

If power is removed from base station (but not moved) power can be restored and same base station position will be used for corrections. If previously used Track 0 is recalled, Shift Track may not be needed.

If power is removed and base station is moved a new position will be calculated when power is restored. If previously used Track 0 is recalled, Shift Track will have to be used to center Track 0 on previous vehicle track.

JS56696,00007EE -19-15APR10-1/1

Absolute Base Mode

IMPORTANT: Absolute Base Mode requires base receiver to be mounted in a rigid position. Tripod is not recommended.

NOTE: Display is not required after base station receiver has been configured to operate in Absolute Survey Base Mode and RTK Radio Frequency, Network ID and Radio Channel have been set.

Connect Display to Base Station.

Press: MENU >> StarFire 3000 button >> RTK softkey

Select Configure button.

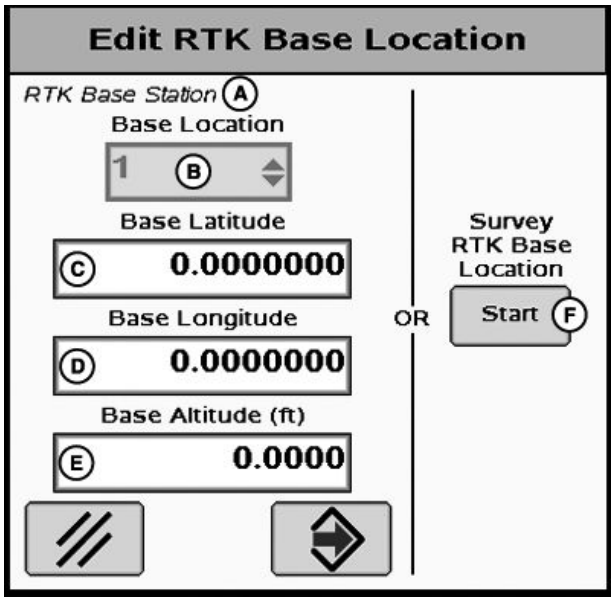
Select Absolute Base from Operating Mode drop-down and set other settings.

After radio is configured, select the Edit Store RTK Base button on lower right.

A 24-hour survey has to be performed and saved to a RTK Base Location (1-200).

NOTE: Enter unique location number each time base station is moved to new mounting location (i.e. location 1 = West 40, location 2 = Farm Shop). Edit Stored RTK Base: Allows operator to setup Absolute Base Station Locations and conduct 24-hour survey or enter in known location coordinates. Unknown Coordinates: Press START button located under Edit Stored RTK Base.

After (24 hour) self survey is complete, base station coordinates will automatically be stored and associated with base location number (1 - 200). Verify base station coordinates, Press START button located under Edit Stored RTK Base while in Absolute Base operating mode and choose base location from base location drop-down box.



Survey RTK Base Location

A—RTK Base Station
B—Base Location
C—Base Latitude
D—Base Longitude
E—Base Altitude
F—Survey RTK Base Location Start button

Continued on next page

Start 24 hour Self Survey

1. Press START button located under Survey RTK Base Location.
2. Select Storage location from drop-down box (1 - 200)
3. Press START button (Starts 24 hour survey)

NOTE: Display can be removed while survey is in progress.

After 24 hour survey is complete, base station will automatically store surveyed coordinates and begin transmitting corrections.

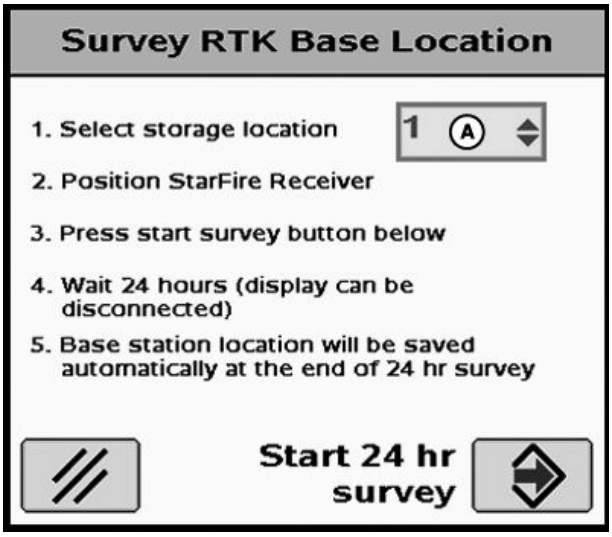
IMPORTANT: Manually record coordinates and elevation and store in safe location. These coordinates may be used to enter previously surveyed base station location into different receiver.

NOTE: Absolute Base Mode, coordinates may be manually entered, if known from previous survey. See Known Location section below.

Known Location

Press START button located under Edit Stored RTK Base.

1. Select desired Base Location from drop-down box (1-200)
2. Select Base Latitude – enter value (deg)
3. Select Base Longitude – enter value (deg)
4. Select Base Altitude – enter value (ft)
5. Press ENTER button



PC12060 —UN—12MAY09

A—Select Storage Location

JS56696,00007EF -19-15APR10-2/2

RTK Network Configuration

Radio Channel - RTK

NOTE: 14 Radio Channels are available. The default Radio Channel is 1.

Press input box and enter value (1 - 14)

The Radio Channel may be changed if other RTK systems are operating in area interference is causing decreased base station communication performance.

Network ID – RTK

NOTE: 4000 network ID's are available, default ID is 1.

Press input box and enter value (1 - 4000)

Network ID for base station and vehicle receiver must match. If more than one base station with same Network ID numbers are within range, vehicle may lock on to either one of the base stations. To prevent this from happening, be sure to use unique network ID.

JS56696,00007F0 -19-15APR10-1/1

Shared Base Station RTK Security

Shared Base Station (SBS) RTK Security is security from unwanted users accessing a SBS RTK Network. This security feature keeps unauthorized RTK vehicles from accessing RTK corrections from the base station by granting access to only those RTK vehicles on an access list.

Compatibility

Base Station This security feature is not available on original StarFire receivers being used as base stations.

RTK Vehicle It is compatible with original StarFire, StarFire iTC, and StarFire 3000 receivers being used as RTK vehicles.

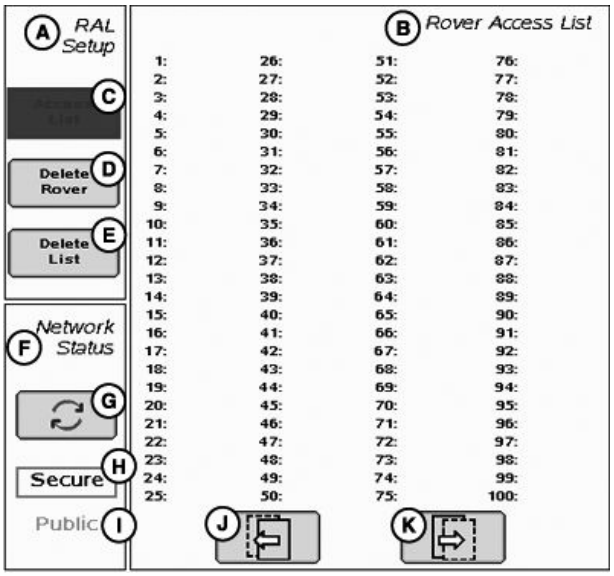
Locating RTK Vehicle Receiver Serial Number
Software Versions Original StarFire Receiver – requires software version of 7.50x or greater. StarFire iTC Receiver – requires software version of 2.50x or greater.

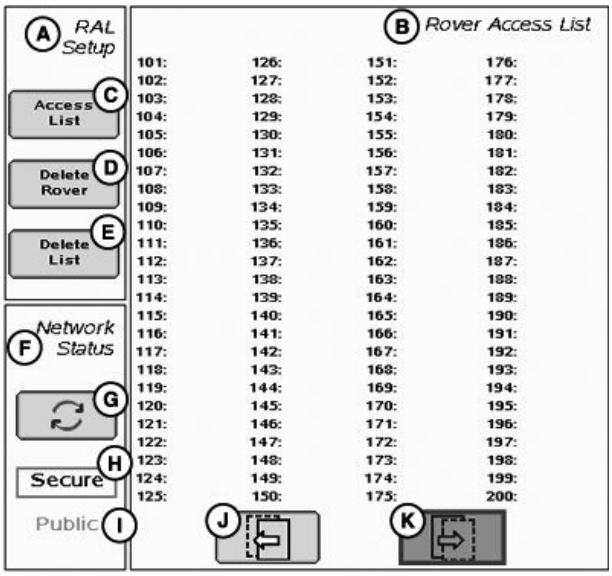
Theory of Operation

The SBS RTK Network operator will enter into the base station the serial numbers of RTK vehicle receivers that are allowed to access the RTK corrections from that base station. RTK vehicle serial numbers can be added and removed at any time with an original GreenStar Display. Only those rover serial numbers that are on the access list on the base station receiver will be allowed to access the RTK corrections from the base station.

JS56696,00007F1 -19-15APR10-1/1

Shared Base Station Security—Setup





A—Rover Access List Setup
B—Rover Access List
C—Access List
D—Delete Rover
E—Delete List
F—Network Status
G—Toggle Button
H—Secure
I—Public
J—Previous Page
K—Next Page

Network ID must be set between 4001 - 4090 to setup and use SBS RTK security. When the network ID has been set between 4001 - 4090, the SBS RTK Security softkey will appear. Select this softkey to setup SBS RTK Security.

The SBS RTK Network operator will enter into the base station the serial numbers of RTK vehicle receivers that are allowed to access the RTK corrections from that base station. RTK vehicle serial numbers can be added and removed at any time. Only those rover serial numbers that are on the access list on the base station receiver will be allowed to access the RTK corrections from the base station.

The StarFire 3000 - Shared Base Station Security screen displays the RTK vehicle receiver serial number and location it is stored. Only the serial numbers on the RAL will be able to receive RTK corrections from the base station when RTK Network is in SECURE mode.

Access List button (C) allows operator to input the serial number of a receiver into the Access List.

Delete Rover button (D) allows operator to remove a receiver from the Access List.

Delete List button (E) allows operator to clear all inputted receiver serial numbers from the Access List.

SBS Security can be operated in a Public or Secure mode.

- Public – This mode does not restrict RTK vehicles from receiving RTK corrections as long as they have the same Network ID and Frequency as the base station. This mode can be used when conducting a RTK demo for potential customers or field days.
- Secure – This mode restricts RTK vehicles from receiving RTK corrections if their serial numbers are not entered into the RAL

Network Status (F) can be toggled between secure status (H) and public status (I) using toggle button (G).

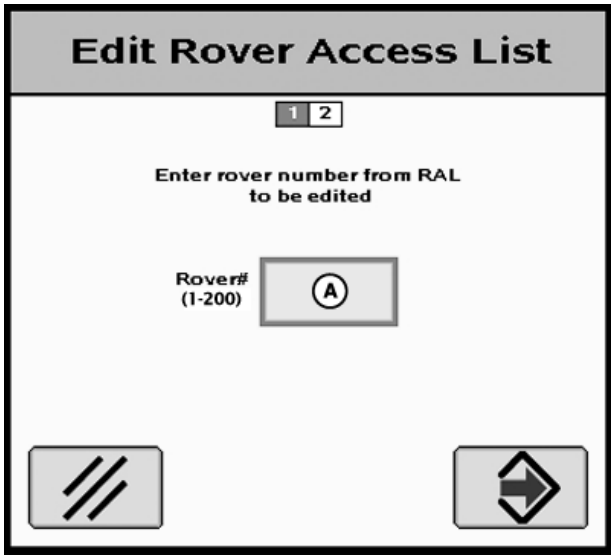
Continued on next page

JS56696,00007F2 -19-15APR10-1/4

Edit Rover Access List

1. Press Access List button on StarFire 3000 - Shared Base Station Security screen.
2. Enter a rover number from the Rover Access List in the entry box.

A—Rover Number (1-200)



PC11635 —UN—02FEB09

Edit Rover Access List — Page 1

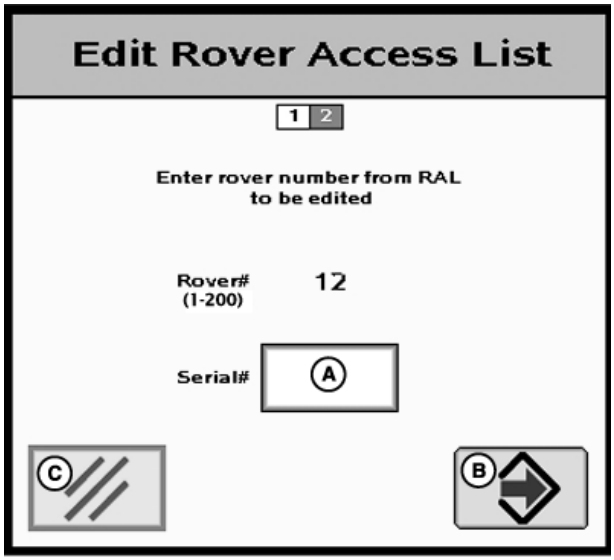
JS56696,00007F2 -19-15APR10-2/4

3. Enter the serial number of the vehicle receiver to be added to the Rover Access List in the entry box (A).

NOTE: The six digit hardware serial number can be found on StarFire 3000 - Activations tab. Go to the display in RTK vehicle and press MENU >> StarFire 3000 >> Activations tab.

4. Press Enter button (B) to put receiver on the Rover Access List.
5. Press Cancel button (C) to return to Rover Access List without adding receiver to list.

A—Serial Number
B—Enter button
C—Cancel button



PC11637 —UN—02FEB09

Edit Rover Access List — Page 2

Continued on next page

JS56696,00007F2 -19-15APR10-3/4

If the serial number is already entered on the Rover Access List, “Serial Number Already Exists.” will appear on the screen.

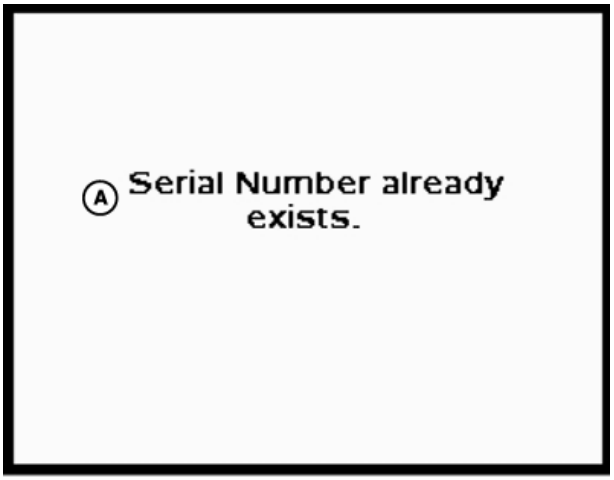
RTK vehicle serial numbers can be deleted individually or the entire list can be deleted.

Deleting individual entries:

1. Press Delete Rover button on StarFire 3000 - Shared Base Station Security screen.
2. Enter rover number to be deleted from the list.
3. Press Delete button (C) to delete the rover from the list.

NOTE: Once a RTK vehicle serial number has been deleted from the RAL, it will take approximately 18 minutes before the RTK vehicle will not longer be able to operate off of that base station. During this time the vehicle will transition into RTK extend.

NOTE: Verify rover has been deleted by viewing RAL list .



PC9599 —UN—10NOV06

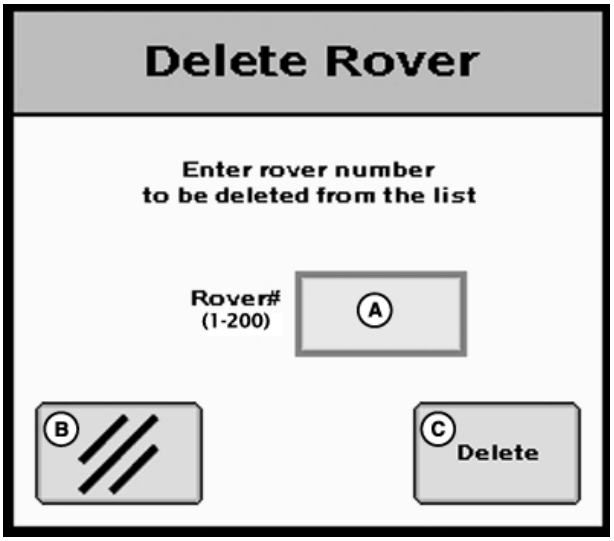
Duplicate Serial Number

A—Serial Number already exists

Deleting All Entries:

1. Press Delete List button on StarFire 3000 - Shared Base Station Security screen.
2. Press Yes button (C) to delete all receivers from the list..

NOTE: Press No button (B) to return to StarFire 3000 - Shared Base Station Security screen without deleting all the receivers from the list.



PC11638 —UN—02FEB09

Delete Rover

A—Rover Number (1-200)
B—Cancel button
C—Delete button

PC9704 —UN—10NOV06

Delete Rover Access List

A—Are you sure you want to delete entire Rover Access List?
B—No
C—Yes

JS56696,00007F2 -19-15APR10-4/4

RTK Vehicle Security Status

The RTK Vehicle (when operating off of a Secure Network ID) will exist in one of the following RTK authorization states: Unknown, Authorized, or Not Authorized.

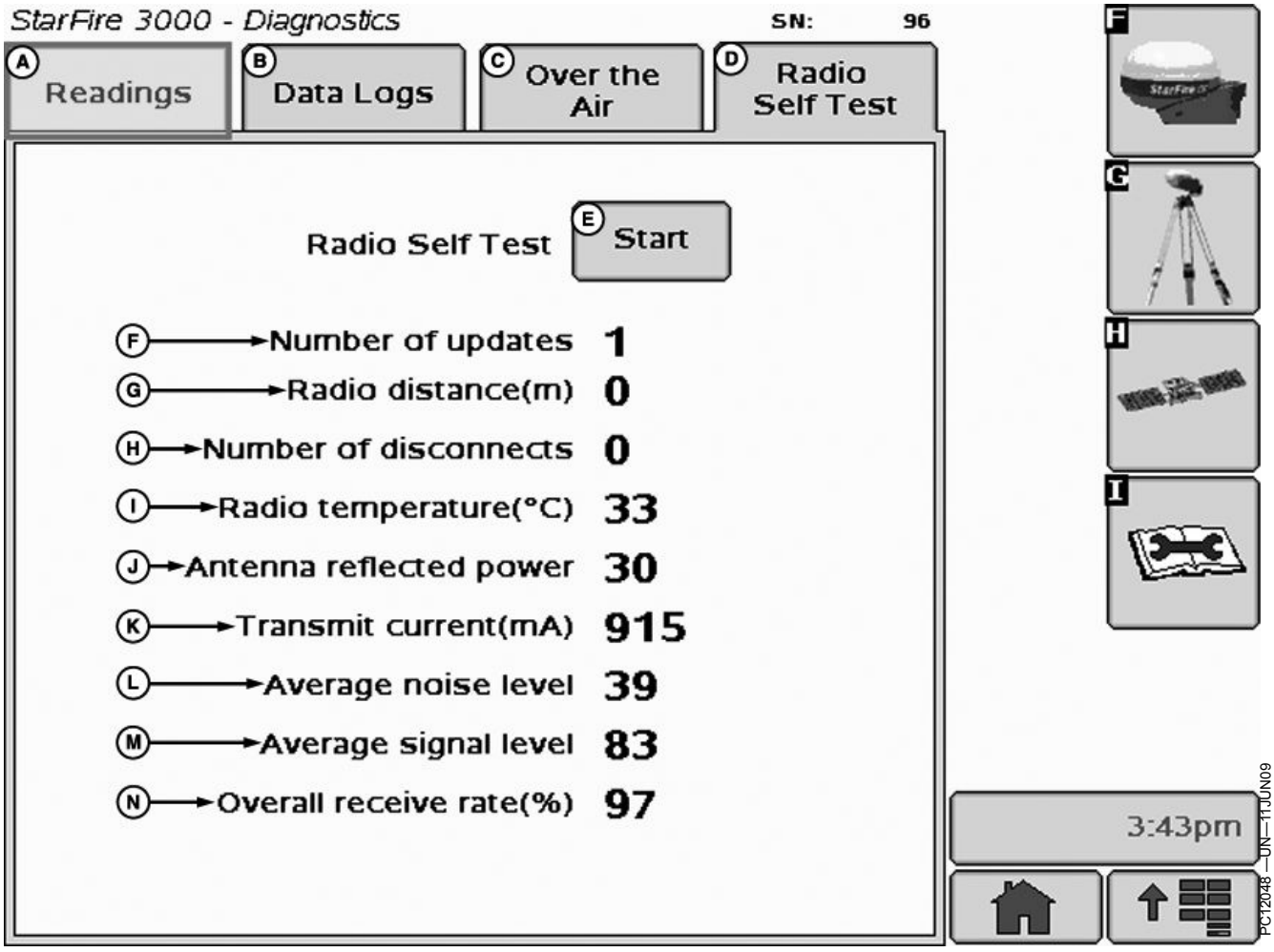
Unknown – The RTK Vehicle StarFire upon power up is in an “unknown” RTK authorization state. It will exist in this state until communication with the base station is established.

Authorized – Satellite Corrections on the RTK screen will become greater than 0 when authorized.

Not Authorized – If not authorized occurs, an alarm will appear on the screen.

JS56696,00007F3 -19-15APR10-1/1

Radio Self Test



A—Readings tab
B—Data Logs tab
C—Over the Air tab
D—Radio Self Test tab
E—Radio Self Test Start button
F—Number of Updates
G—Radio Distance (m)
H—Number of Disconnects
I— Radio Temperature
J— Antenna Reflected Power
K—Transmit Current (mA)
L— Average Noise Level
M—Average Signal Level
N—Overall Receive Rate (%)

IMPORTANT: The Radio Self Test needs to be performed while the vehicle is not moving.

StarFire 3000 MUST be in RTK mode to perform the radio self test.

NOTE: This is an average and putting the radio into test mode will decrease this average until it is put back into operational mode and allowed to run for several minutes.

(G) Radio Distance — Distance from master to slave radio.

(I) Radio Temperature — Internal temperature of the radio, measured in degrees Celsius. Acceptable range of values: -40 to +75 degrees Celsius.

(J) Antenna Reflected Power — A voltage ratio used to indicate problems with the antenna. Higher values (above 75) generally indicate issues with the antenna, possibly an antenna that is broken.

(K) Transmit current — Amount of current consumed during radio transmission. Acceptable operating range is approximately 500 mA or less. Value can range any where between 400 and 1000 mA.

(L) Average Noise level — Level of background noise and interference seen at this radio. This is an average reading taken at regular intervals by the radio. Putting the radio in setup mode (which is what happens during the radio test) will affect this reading. Average noise levels would be somewhere between 15 and 30. Levels lower than 15 are ok, but levels higher than 30 may start to show signs of signal degradation.

Continued on next page

DK01672,000020A -19-01DEC11-1/3

(M) Average signal level — Level of received signal that this radio is seeing from the other radio transmitting to it. This value should be at least a value of 15 higher than the noise. If it is not, the link between the two radios is probably not stable and reliable.

(N) Overall receive rate —Percentage of data that was successfully transmitted from master to slave radio on the first attempt. Values higher than 75 indicate a good radio link.

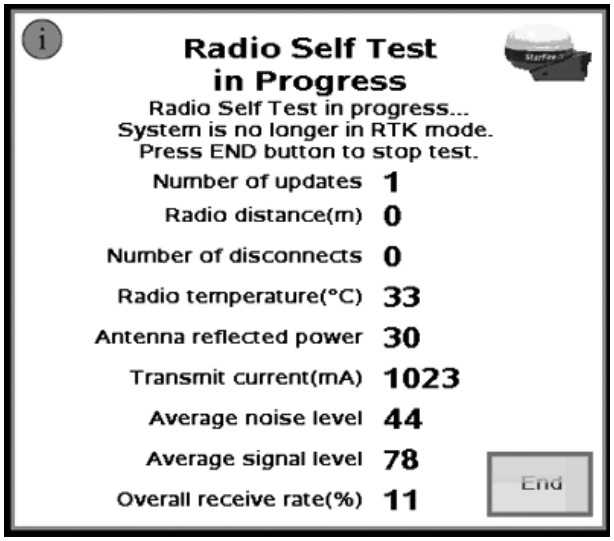
DK01672,000020A -19-01DEC11-2/3

While the test is in progress the screen will read:

Radio Self Test in progress. . .

System is no longer in RTK mode.

Select END button to stop test.



PC12047 —UN—12MAY09

DK01672,000020A -19-01DEC11-3/3

Operating Mode

IMPORTANT: Before starting SETUP procedures, enter RTK activation number, see Enter RTK Activation section.

NOTE: Radio can function in six different modes:

- *Vehicle*
- *Quick Survey Base Mode*
- *Absolute Base Mode*
- *Vehicle Repeater*
- *Repeater*
- *Off*

Screen: SETUP - RTK

Press: SETUP >> StarFire 3000 >> DIFF CORRECTION SETUP >> RTK SETUP

Press letter button next to RTK OPERATION MODE and toggle to desired selection.

Quick Survey Base Mode	Absolute Base Mode
Custom Operations	Drip Tape
Tillage	Strip Till
Broad-acre Seeding	Controlled Traffic
	Row Crop

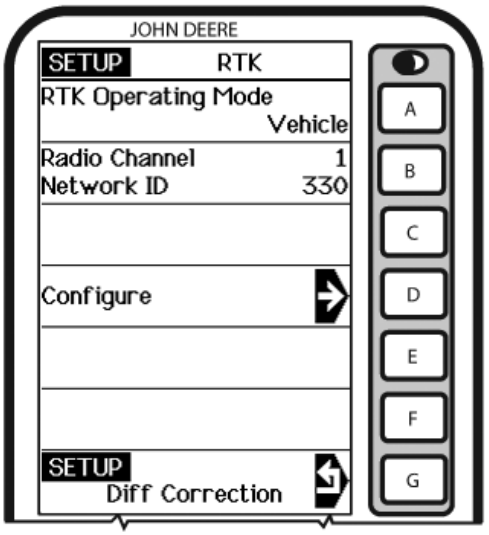
Suggested Base Station Mode For Operation

Vehicle Mode: Select for receiver on vehicle.

Vehicle Repeater Mode: This mode should only be used in situations where multiple RTK vehicles are operating in the same field and due to the terrain, line-of-sight is obstructed between one of the vehicles and the base station.

Quick Survey Base Mode: Select if exact location of guidance tracks do not need to be stored for future applications. If Quick Survey Base Mode is used to establish rows or paths that will be used at a later date, location of Track 0 must be saved using Current Field setting in Tracking Setup (see AutoTrac Operator's Manual). When Current Field is recalled, a one-time use of Shift Track feature will be needed to align vehicle on previous tracks. See Setup Quick Survey Base Mode section.

NOTE: Quick Survey Base Mode requires a 15 minute self survey to be conducted on location before first use.



PC12080 —UN—13MAY09

SETUP - RTK

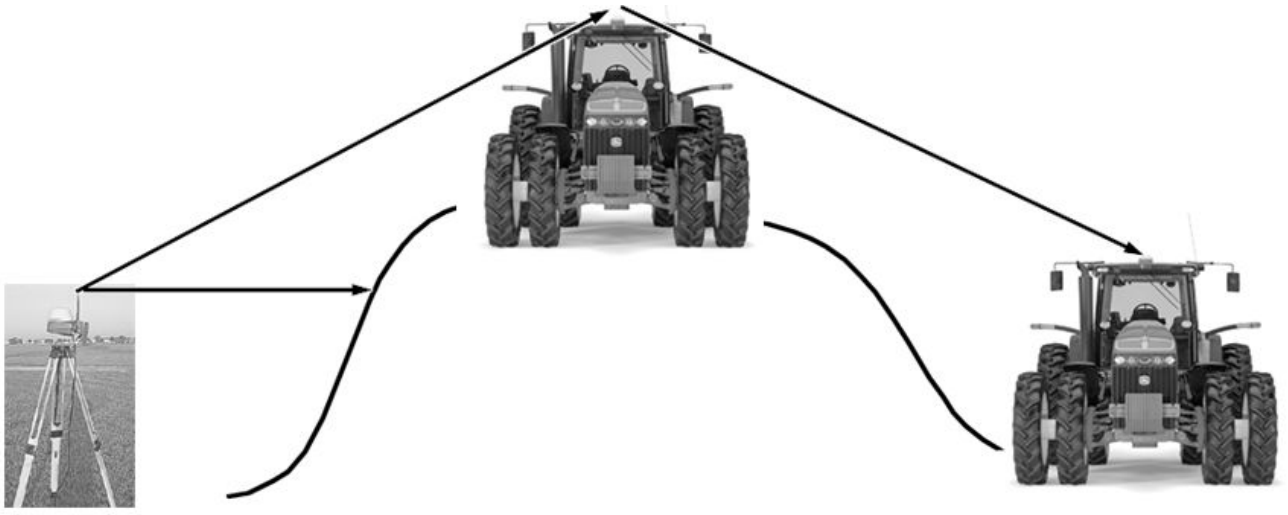
A—RTK Operating Mode
B—RTK Radio Channel Network ID
C——
D—Configure
E——
F——
G—Return to Differential Correction

Absolute Survey Base Mode: Select if exact location of guidance tracks need to be stored for future guidance applications without relying on visual reference for track position to align using Shift Track feature. Track 0 must be stored using Current Field in Tracking Setup in order to follow previously used tracks. Absolute Base Mode requires 24-hour self survey to be conducted on location before first use. After survey is completed, base station will then transmit corrections. If base station is moved to another position and then returned to original surveyed position, it is very important that base station is mounted in exact same position. Any difference between original surveyed position and mounted position will result in offset of corrected position. For this reason, it is important to mount receiver to a fixed position like building or post mounted in concrete.

OFF Mode: This mode disables all RTK functionality in receiver. RTK Operating Mode must be OFF for normal SF2 operation on SF2 licensed receiver.

JS56696,00007F4 -19-15APR10-1/1

Vehicle Repeater



Press: SETUP button >> StarFire 3000 >> Differential Correction Setup (D) >> RTK Setup (A)

Toggle (A) button next to RTK Operating Mode until “VEHICLE REPEATER” appears in the cell.

In this mode the RTK vehicle radio not only receives messages but also rebroadcasts them (similar to a RTK repeater) to other RTK vehicles in close proximity.

NOTE: Vehicle Repeater is identical to the Vehicle mode with the addition of having the radio rebroadcast the RTK messages.

The Vehicle Repeater mode allows an RTK vehicle to function normally as an RTK vehicle while also transmitting the base correction signal to another RTK vehicle that does not have line-of-sight to the base station.

The ‘Vehicle Repeater’ needs to be between the base station and the ‘Vehicle’. The ‘Vehicle Repeater’ must be able to communicate with the base station. The ‘Vehicle’ must then have either line of sight communication to the base station or ‘Vehicle Repeater’.

IMPORTANT: There should be only ONE Vehicle Repeater or Repeater in the same vicinity with the same Network ID.

JS56696,00007F5 -19-15APR10-1/1

Quick Survey Mode

NOTE: Display is not required after base station receiver has been configured to operate in Quick Survey Base Mode and RTK Frequency, Radio Channel/Network ID have been set.

Connect display to base station..

Screen: SETUP - RTK

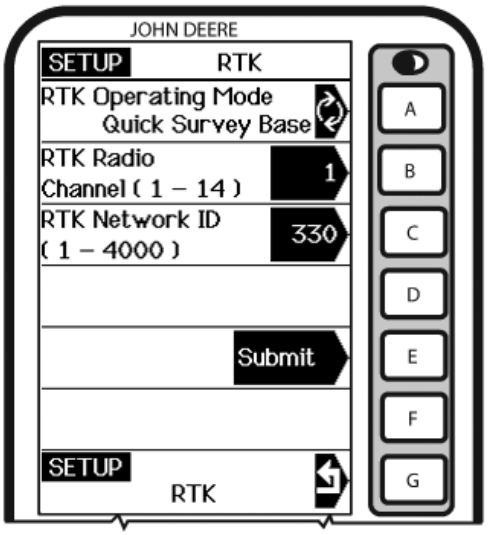
Press: SETUP >> StarFire 3000 >> DIFF CORRECTION SETUP >> RTK SETUP

NOTE: Quick Survey Base Mode allows base station to broadcast corrections after receiver calculates GPS position.

If power is removed from base station (but not moved) power can be restored and same base station position will be used for corrections. If previously used Track 0 is recalled in Parallel Tracking/Auto Trac no Shift Track will be needed.

If power is removed and base station is moved, a new position will be calculated when power is restored. If previously used Track 0 is recalled in Parallel Tracking/Auto Trac, use Shift Track. (See AutoTrac Operator's Manual for Shift Track procedures.)

Press letter button next to RTK OPERATING MODE and toggle to QUICK SURVEY BASE MODE.



PC12081 —UN—13MAY09

SETUP - RTK

A—RTK Operating Mode
B—RTK Radio Channel
C—RTK Network ID
D——
E—Submit
F——
G—Ruturn to RTK setup

JS56696,00007F6 -19-15APR10-1/1

Absolute Mode

IMPORTANT: Absolute Base Mode requires base receiver to be mounted in a rigid position. Tripod is not recommended.

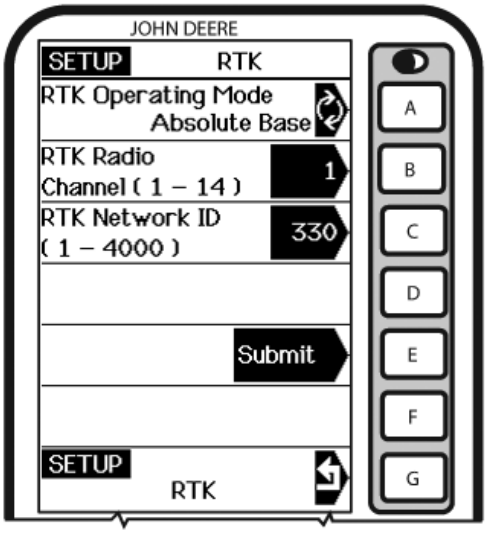
NOTE: Display is not required after base station receiver has been configured to operate in Absolute Survey Base Mode and RTK Radio Channel/Network ID have been set.

Connect display to base station.

Screen: SETUP - RTK

Press: SETUP >> StarFire 3000 >> DIFF CORRECTION SETUP >> RTK SETUP

Press letter button next to RTK OPERATING MODE and toggle to ABSOLUTE SURVEY BASE MODE.



PC12082 —UN—13MAY09

SETUP - RTK

A—RTK Operating Mode
B—RTK Radio Channel
C—RTK Network ID
D——
E—Submit
F——
G—Return to RTK Setup

Continued on next page

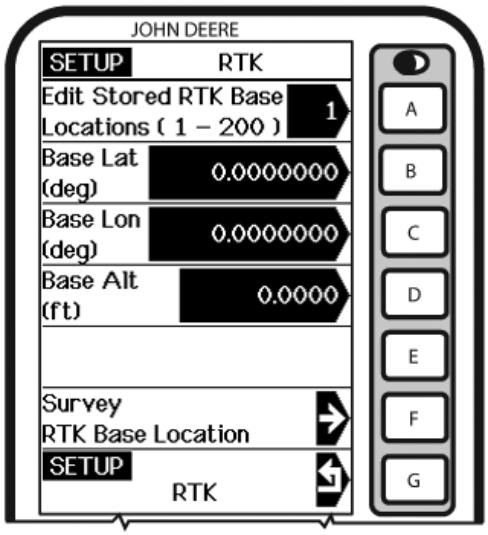
JS56696,00007F7 -19-15APR10-1/3

Press letter button next to EDIT STORED RTK BASE LOCATION (1-200) and SETUP - RTK screen will be displayed.

NOTE: Enter unique location number each time base station is moved to new mounting location (i.e. location 1 = West 40, Field location 2 = North 80, Field location 3 = Farm shop).

Press letter button next to EDIT STORED RTK BASE LOCATION (1-200) and enter desired location number.

A—Edit Stored RTK Base Locations
B—Base Latitude
C—Base Longitude
D—Base Altitude
E——
F—Survey RTK Base Location
G—Return to RTK Setup



PC12083 —UN—13MAY09

SETUP - RTK

Continued on next page

JS56696,00007F7 -19-15APR10-2/3

Not known coordinates: Press letter button next to SURVEY RTK BASE LOCATION.

NOTE: After (24 hour) self survey is complete, base station coordinates will automatically be stored and associated with base location number (1-200). Verify base station coordinates, see RTK INFO Pages.

Press letter button next to START SELF SURVEY. Display can be removed while survey is in progress.

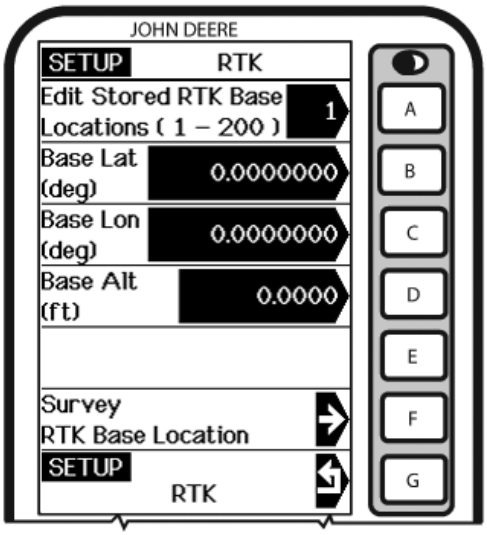
After 24 hour survey is complete, base station will automatically store surveyed coordinates and begin transmitting corrections. Manually record coordinates and elevation and store in safe location. These coordinates may be used to enter previously surveyed base station location into different receiver.

NOTE: Absolute Base Mode, coordinates may be manually entered, if known from previous survey.

Known Location: Press letter button next to BASE (LATITUDE, LONGITUDE AND ALTITUDE) and enter values for;

- Base Lat (deg)
- Base Lon (deg)
- Base Alt (ft)

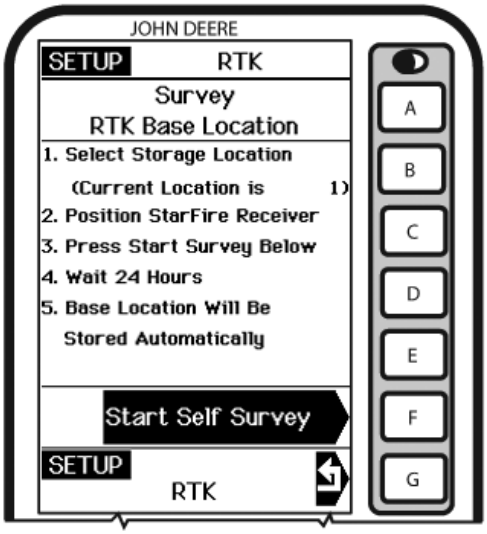
A—Survey RTK Base Location
B—Select Storage Location
C—Position StarFire Receiver Press Start Survey Below
D—Wait 24 hours
E—Base Location will be Stored Automatically
F—Start Self Survey
G—Return to RTK Setup



PC12119 —UN—10JUN09

SETUP - RTK

A—Edit Stored RTK Base Locations (1 - 200)
B—Base Latitude (deg)
C—Base Longitude (deg)
D—Base Altitude
E——
F—Survey RTK Base Location
G—Return to RTK Setup



PC12084 —UN—13MAY09

Setup - RTK

JS56696,00007F7 -19-15APR10-3/3

Shared Base Station RTK Security

SBS RTK Security is security from unwanted users accessing a SBS RTK Network. This security feature keeps unauthorized RTK vehicles from accessing RTK corrections from the base station by granting access to only those RTK vehicles on an access list.

Compatibility

Base Station This security feature is not available on original StarFire receivers being used as base stations. All setup must be performed with an Original GreenStar Display.

Theory of Operation

The SBS RTK Network operator will enter into the base station the serial numbers of RTK vehicle receivers that are allowed to access the RTK corrections from that base station. RTK vehicle serial numbers can be added and removed at any time with an original GreenStar Display. Only those rover serial numbers that are on the access list on the base station receiver will be allowed to access the RTK corrections from the base station.

Base Station Setup (Original GreenStar Display Only)

Screen: SETUP – RTK

Press: SETUP >> StarFire 3000 >> DIFF CORRECTION SETUP >> RTK SETUP

NOTE: RTK base station must be operating in either Quick Survey Base or Absolute Base Mode.

Enter a RTK Network ID between 4001 – 4090 (secure Network ID range) in cell “C”.

RTK SECURE NETWORK will appear in cell “F”. Select letter button “F”

Entering RTK vehicle (rover) serial numbers

Press letter button next to ROVER # (1-200) and enter desired location number to store the RTK vehicle receiver serial number. There are 200 slots available.

Press letter button next to ROVER HARDWARE SN and enter serial number of RTK vehicle StarFire receiver.

NOTE: Original GreenStar Display - The six digit hardware serial number can be found on INFO – GPS – PAGE 3. Go to display in RTK vehicle: Press INFO >> StarFire 3000 >> press PAGE button until you reach PAGE 3.

NOTE: GreenStar 2100/2600 Display – The six digit hardware serial number can be found on StarFire 3000 - ACTIVATIONS tab. Go to display in RTK vehicle: Press MENU >> StarFire 3000 >> ACTIVATIONS tab.

Rover Access List (RAL)

Screen: SETUP – RAL

Press: SETUP >> StarFire 3000 >> DIFF CORRECTION SETUP >> RTK SETUP >> RTK SECURE NETWORK >> DISPLAY AUTHORIZED LIST.

This displays the RTK vehicle receiver serial number and location it is stored. Only the serial numbers on the RAL will be able to receive RTK corrections from the base station when RTK Network is in SECURE mode (see Security Mode section below).

Press PAGE button to view subsequent pages of the RAL.

RTK Network Operating Mode

Screen: SETUP - RTK

Press: SETUP >> StarFire 3000 >> DIFF CORRECTION SETUP >> RTK SETUP >> RTK SECURE NETWORK >> RTK NETWORK IS CURRENTLY.

SBS Security can be operated in a Public or Secure mode.

- Public – This mode does not restrict RTK vehicles from receiving RTK corrections as long as they have the same Network ID as the base station. This mode can be used when conducting a RTK demo for potential customers or field days.
- Secure – This mode restricts RTK vehicles from receiving RTK corrections if their serial numbers are not entered into the RAL

Deleting RAL

Screen: SETUP – RTK

Press: SETUP >> StarFire 3000 >> DIFF CORRECTION SETUP >> RTK SETUP >> RTK SECURE NETWORK >> DELETE ENTIRE LIST

RTK vehicle serial numbers can be deleted individually or the entire list can be deleted.

Deleting individual entries:

Press letter button next to ROVER # (1-200). Enter the vehicle receiver stored number that will be deleted (1-200).

Press letter button next to ROVER HARDWARE SN. Enter a non-zero number (example: “1”) in place of the serial number. The serial number has been removed from the RAL.

NOTE: Once a RTK vehicle serial number has been deleted from the RAL, it will take approximately 18 minutes before the RTK vehicle will no longer be able to operate off of that base station. During this time, the vehicle will transition into RTK extend.

Deleting entire list

Press letter button next to DELETE ENTIRE LIST.

Press letter button next to SUBMIT. It will change to DELETED once the RAL has been deleted.

NOTE: Verify RAL has been deleted by viewing RAL list (See Rover Access List section above).

Continued on next page

RTK Vehicle Setup

Original GreenStar Display

Screen: SETUP – RTK StarFire 3000

Press: SETUP >> StarFire 3000 >> DIFF CORRECTION SETUP >> RTK SETUP >> VEHICLE

Original StarFire

Press: SETUP >> StarFire 3000 >> DIFF CORRECTION SETUP >> RTK SETUP >> VEHICLE

NOTE: RTK vehicle can be operated in either Vehicle or Vehicle Repeater Mode.

Enter the same RTK Network ID that the base station is configured to.

RTK Vehicle Security Status

The RTK Vehicle (when operating off of a Secure Network ID) will exist in one of the three following RTK authorization states: Unknown, Authorized, or Not Authorized.

These states are displayed in one or more of the following locations depending on display and receiver used:

(Displayed on INFO – GPS – PAGE 3 (StarFire 3000) or PAGE 5 (Original StarFire) or Cell G on GSD or on Cell G of the Original GreenStar Monitor on a GS2 display).

Unknown – The RTK Vehicle StarFire, upon power up, is in an "unknown" RTK authorization state. It will exist in this state until communication with the base station is established. No message will be displayed in cell G of the GreenStar Display.

Authorized – On power-up of a RTK Vehicle StarFire that is properly configured and on the authorization list, the message "RTK Network: Authorized" will be displayed in cell G as soon as it establishes communication with the secure RTK base station, and it determines that it is authorized to receive RTK corrections.

Unauthorized – On power-up of a RTK Vehicle StarFire that is properly configured, but the serial number has not been entered into the base station RAL, the message "RTK Network: Not Authorized" will be displayed in cell G as soon as it establishes communication with the secure RTK base station, and it determines that it is not authorized to receive RTK corrections.

DK01672,00001C0 -19-11NOV11-2/2

Radio Channel

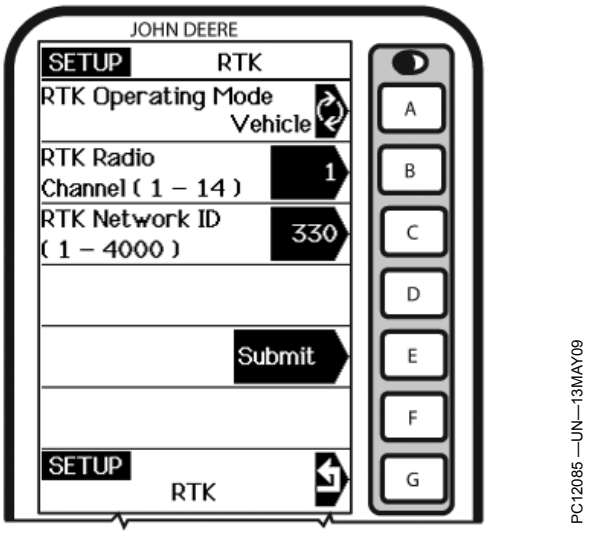
NOTE: 14 Radio Channels are available. The default Radio Channel is 1

Screen: SETUP - RTK

Press: SETUP >> StarFire 3000 >> DIFF CORRECTION SETUP >> RTK SETUP

The Radio Channel may be changed if other RTK systems are operating in area and interference is causing decreased base station communication performance.

A—RTK Operating Mode
B—RTK Radio Channel
C—RTK Network ID
D——
E—Submit
F——
G—Return to RTK Setup



PC12085 —UN—13MAY09

SETUP - RTK

JS56696,00007F9 -19-15APR10-1/1

Network ID

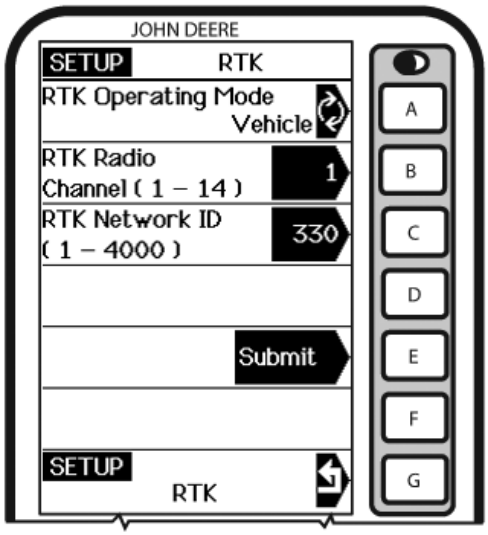
NOTE: 4000 network ID's are available (default ID is 1).

Screen: SETUP - RTK

Press: SETUP >> StarFire 3000 >> DIFF CORRECTION SETUP >> RTK SETUP

Network ID for base station and vehicle receiver must match. If more than one base station with same Network ID numbers are within range, vehicle may lock on to either one of base stations. To prevent this from happening, be sure to use unique network ID.

A—RTK Operating Mode
B—RTK Radio Channel
C—RTK Network ID
D——
E—Submit
F——
G—Return to RTK Setup



PC12085 —UN—13MAY09

SETUP - RTK

JS56696,00007FA -19-15APR10-1/1

Repeater

NOTE: The radio can be configured to act separately as repeater. A repeater is required if obstructions (i.e. trees, hills, etc.) exist between base station and vehicle(s).

A repeater consists of:

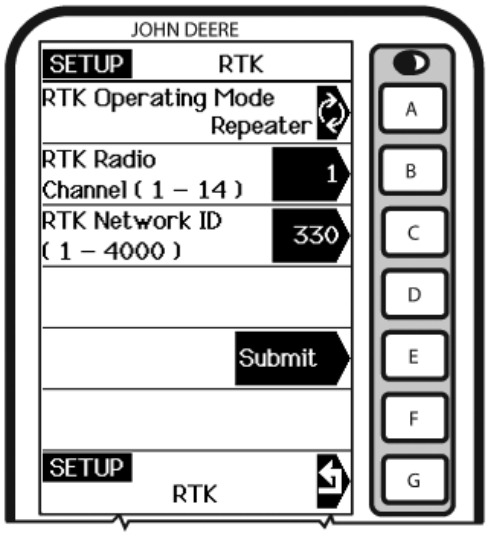
- *Radio (configured as a repeater)*
- *Harness*
- *Mounting Bracket*
- *12 Volt Power Source*

To configure radio as repeater:

Screen: SETUP - RTK

Press: SETUP >> StarFire 3000 >> DIFF CORRECTION SETUP >> RTK SETUP

1. Connect radio to receiver RTK harness.
2. Check that receiver has GPS position calculated.
3. Check that base station, vehicle, and repeater have same Frequency, Network ID and Radio Channel.
4. Toggle RTK Operating Mode to Repeater.
5. Radio will configure as repeater.
6. Disconnect repeater from receiver and wiring harness.
7. Reconnect original radio.



PC12086 —UN—13MAY09

SETUP - RTK

A—RTK Operating Mode
B—RTK Radio Channel
C—RTK Network ID
D——
E—Submit
F——
G—Return to RTK Setup

8. Toggle Mode to Vehicle.

JS56696,00007FB -19-15APR10-1/1

Operating Vehicle

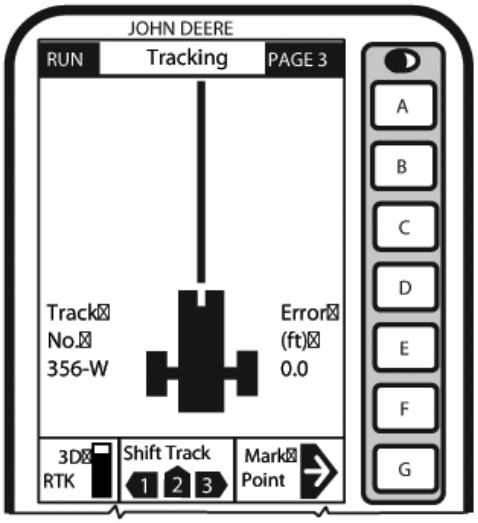
IMPORTANT: The base station receiver and vehicle receiver must be setup before operating RTK. See Setup sections for setup procedures.

When vehicle receiver is powered-up, No GPS, No Diff will be displayed on RUN - TRACKING - PAGE screen until an initial position is determined. When base station transmits correction signal, 3D RTK will be displayed on RUN - TRACKING - PAGE screen.

NOTE: If communication loss is WITHIN first hour of base station operation, Extend Mode will provide RTK accuracy for two minutes.

Communication loss AFTER first hour of base station operation, Extend Mode will provide RTK accuracy for 15 minutes.

A——
B——
C——
D——
E—Track Number, Error
F——
G—3D RTK, Shift Track, Mark Point

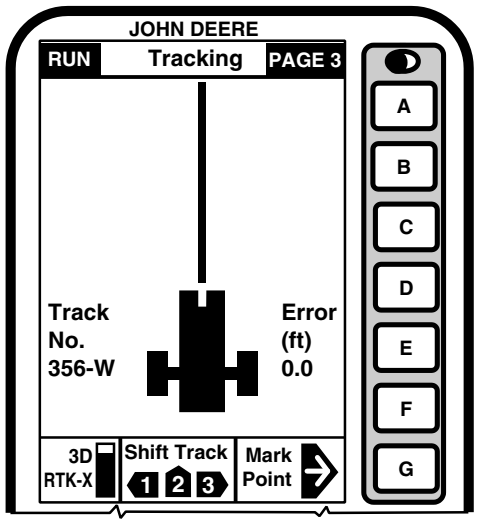


RUN - Tracking - PAGE 3

JS56696,00007FC -19-15APR10-1/2

Extend Mode (RTK-X): If communication between base station and vehicle radio is lost for more than 10 seconds, vehicle receiver will automatically switch to Extend Mode and will maintain RTK accuracy for a period of time. RTK-X will be available for approximately 2 to 15 minutes if base station has been powered up for less than 1 hour. If base station communication is not re-established after Extend period, receiver will default to WAAS, or NO DIFF where WAAS is not available.

A——
B——
C——
D——
E—Track Number, Error
F——
G—3D RTK, Shift Track, Mark Point



RUN - Tracking - PAGE 3

JS56696,00007FC -19-15APR10-2/2

INFO Pages, Base Station

Screen: INFO - GPS - PAGE 5

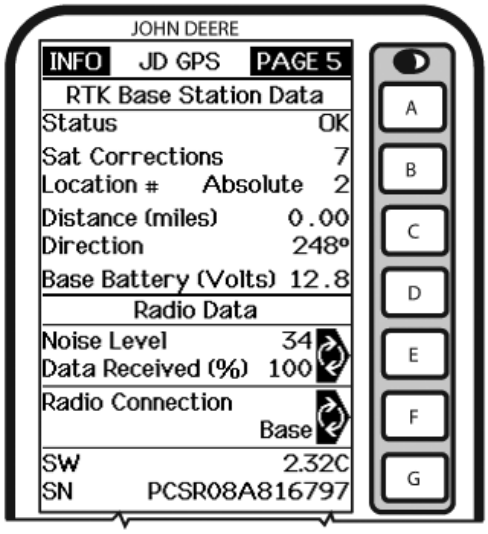
This screen allows operator to view:

- **Status**
  - OK - Base Station is transmitting correction.
  - No Stored Base - 24 hour self survey is required for current location.
  - Initializing - Receiver is initializing radio, acquiring GPS signal.
  - Self Survey - 24 hour self survey in progress.
- **Sat Corrections** - Indicates number of GPS satellites for which base station is transmitting correction.
- **Distance** - Difference between base station location (known position) and location indicated by uncorrected GPS.
- **Direction** - Direction from base station location (known position) to location indicated by uncorrected GPS.
- **Base Battery (volts)** - Base Station voltage.
- **Signal Level** - Level of signal that is detected at radio. The signal level will range from 0 to 100 (-180 dBm to -80 dBm or above). Press E button to refresh signal level.

  NOTE: For Data Received (%): Value less than 100 % indicates an obstruction between base station radio and vehicle radio.

  If percent of received correction is 0, and signal level is high, check for potential radio interference sources such as two-way radios, radio towers, etc.

- **Data Received (%)** - Percent of received correction to base station from vehicle.
- **Radio Connection** - Indicates source of correction. If there is no connection, this will toggle between base and repeater.



PC12087 —UN—13MAY09

A—RTK Base Station Data Status
B—Satellite Corrections Location Number
C—Distance Direction
D—Base Battery Radio Data
E—Signal Level Data Received
F—Radio Connection
G—Software Version Serial Number

- **SW** - Version of radio software
- **SN** - Serial number of radio connected to receiver.

JS56696,00007FD -19-15APR10-1/1

INFO Pages, Vehicle

Screen: INFO - GPS - PAGE 5

This screen allows operator to view:

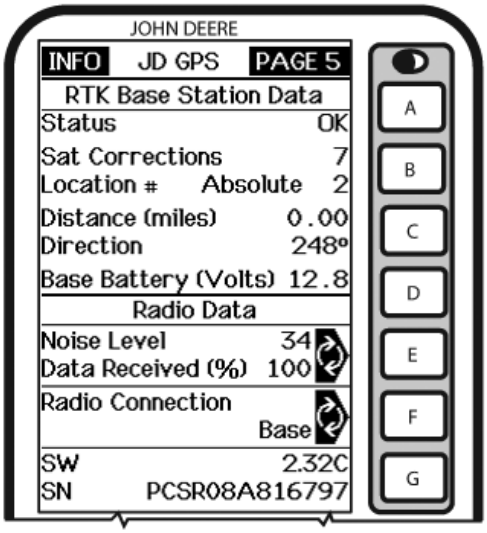
- **Status**
  - OK - Base Station is transmitting correction.
  - No Stored Base - 24 hour self survey is required for current location.
  - Initializing - Receiver is initializing radio, acquiring GPS signal.
  - Self Survey - 24 hour self survey in progress at base station.
  - No Signal - Vehicle radio is not receiving signal from base station.
- **Sat Corrections** - Indicates number of GPS satellites for which base station is transmitting correction.
- **Distance** - Distance from base station to vehicle receiver.
- **Direction** - Direction in degrees to base station.
- **Base Battery (volts)** - Base Station voltage.
- **Signal Level** - Level of signal that is detected at radio. The signal level will range from 0 to 100 (-180 dBm to -80 dBm or above). Press E button to refresh signal level.

  NOTE: For Data Received (%): Value less than 100 % indicates an obstruction between base station radio and vehicle radio.

  If percent of received correction is 0, and signal level is high, check for potential radio interference sources such as two-way radios, radio towers, etc.

  If percent of received correction is 0, and signal level is low, check for potential obstructions of line of sight conditions such as hills, buildings, trees, etc.

- **Data Received (%)** - Percent of received correction to vehicle from base station.



PC12087 —UN—13MAY09

Vehicle connected to Absolute Base

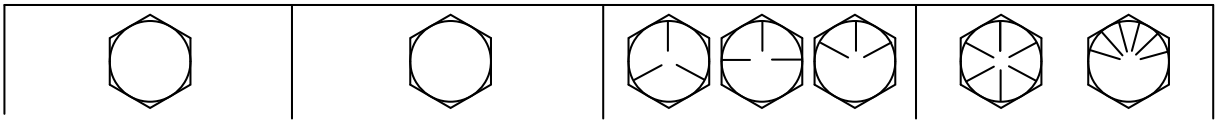
A—RTK Base Station Data Status
B—Satellite Corrections Location Number
C—Distance Direction
D—Base Battery Radio Data
E—Signal Level Data Received
F—Radio Connection
G—Software Version Serial Number

- **Radio Connection** - Indicates source of correction. If there is no connection, this will toggle between base and repeater.
- **SW** - Version of radio software.
- **SN** - Serial number of radio connected to receiver.

JS56696,00007FE -19-15APR10-1/1

Unified Inch Bolt and Screw Torque Values

TS1671 —UN—01MAY03



Bolt or Screw Size	SAE Grade 1				SAE Grade 2[a]				SAE Grade 5, 5.1 or 5.2				SAE Grade 8 or 8.2			
	Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]	
	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.
1/4	3.7	33	4.7	42	6	53	7.5	66	9.5	84	12	106	13.5	120	17	150
													N·m	lb.-ft.	N·m	lb.-ft.
5/16	7.7	68	9.8	86	12	106	15.5	137	19.5	172	25	221	28	20.5	35	26
									N·m	lb.-ft.	N·m	lb.-ft.				
3/8	13.5	120	17.5	155	22	194	27	240	35	26	44	32.5	49	36	63	46
			N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.								
7/16	22	194	28	20.5	35	26	44	32.5	56	41	70	52	80	59	100	74
	N·m	lb.-ft.														
1/2	34	25	42	31	53	39	67	49	85	63	110	80	120	88	155	115
9/16	48	35.5	60	45	76	56	95	70	125	92	155	115	175	130	220	165
5/8	67	49	85	63	105	77	135	100	170	125	215	160	240	175	305	225
3/4	120	88	150	110	190	140	240	175	300	220	380	280	425	315	540	400
7/8	190	140	240	175	190	140	240	175	490	360	615	455	690	510	870	640
1	285	210	360	265	285	210	360	265	730	540	920	680	1030	760	1300	960
1-1/8	400	300	510	375	400	300	510	375	910	670	1150	850	1450	1075	1850	1350
1-1/4	570	420	725	535	570	420	725	535	1280	945	1630	1200	2050	1500	2600	1920
1-3/8	750	550	950	700	750	550	950	700	1700	1250	2140	1580	2700	2000	3400	2500
1-1/2	990	730	1250	930	990	730	1250	930	2250	1650	2850	2100	3600	2650	4550	3350

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For plastic insert or crimped steel type lock nuts, for stainless steel fasteners, or for nuts on U-bolts, see the tightening instructions for the specific application. Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Replace fasteners with the same or higher grade. If higher grade fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

[a] Grade 2 applies for hex cap screws (not hex bolts) up to 6 in. (152 mm) long. Grade 1 applies for hex cap screws over 6 in. (152 mm) long, and for all other types of bolts and screws of any length.

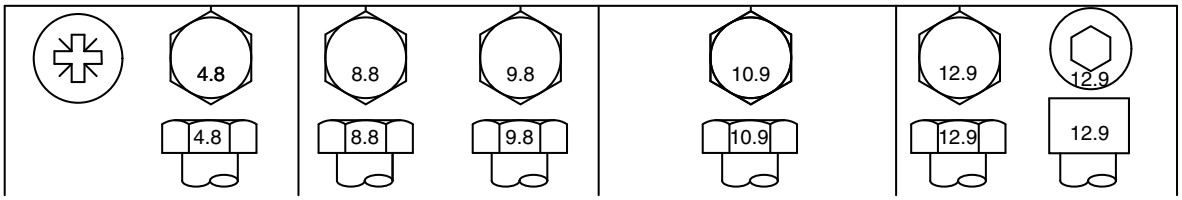
[b] "Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or 7/8 in. and larger fasteners with JDM F13C, F13F or F13J zinc flake coating.

[c] "Dry" means plain or zinc plated without any lubrication, or 1/4 to 3/4 in. fasteners with JDM F13B, F13E or F13H zinc flake coating.

DX,TORQ1 -19-12JAN11-1/1

Metric Bolt and Screw Torque Values

TS1670 —UN—01MAY03



Bolt or Screw Size	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
	Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]	
	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.
M6	4.7	42	6	53	8.9	79	11.3	100	13	115	16.5	146	15.5	137	19.5	172
									N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.
M8	11.5	102	14.5	128	22	194	27.5	243	32	23.5	40	29.5	37	27.5	47	35
			N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.								
M10	23	204	29	21	43	32	55	40	63	46	80	59	75	55	95	70
	N·m	lb.-ft.														
M12	40	29.5	50	37	75	55	95	70	110	80	140	105	130	95	165	120
M14	63	46	80	59	120	88	150	110	175	130	220	165	205	150	260	190
M16	100	74	125	92	190	140	240	175	275	200	350	255	320	235	400	300
M18	135	100	170	125	265	195	330	245	375	275	475	350	440	325	560	410
M20	190	140	245	180	375	275	475	350	530	390	675	500	625	460	790	580
M22	265	195	330	245	510	375	650	480	725	535	920	680	850	625	1080	800
M24	330	245	425	315	650	480	820	600	920	680	1150	850	1080	800	1350	1000
M27	490	360	625	460	950	700	1200	885	1350	1000	1700	1250	1580	1160	2000	1475
M30	660	490	850	625	1290	950	1630	1200	1850	1350	2300	1700	2140	1580	2700	2000
M33	900	665	1150	850	1750	1300	2200	1625	2500	1850	3150	2325	2900	2150	3700	2730
M36	1150	850	1450	1075	2250	1650	2850	2100	3200	2350	4050	3000	3750	2770	4750	3500

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For stainless steel fasteners or for nuts on U-bolts, see the tightening instructions for the specific application. Tighten plastic insert or crimped steel type lock nuts by turning the nut to the dry torque shown in the chart, unless different instructions are given for the specific application.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class. Replace fasteners with the same or higher property class. If higher property class fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

[a] "Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or M20 and larger fasteners with JDM F13C, F13F or F13J zinc flake coating.

[b] "Dry" means plain or zinc plated without any lubrication, or M6 to M18 fasteners with JDM F13B, F13E or F13H zinc flake coating.

DX,TORQ2 -19-12JAN11-1/1

Index

Continued on next page

Page

John Deere Service Literature Available

Technical Information

Technical information can be purchased from John Deere. Some of this information is available in electronic media, such as CD-ROM disks, and in printed form. There are many ways to order. Contact your John Deere dealer. Call **1-800-522-7448** to order using a credit card. Search online from http://www.JohnDeere.com. Please have available the model number, serial number, and name of the product.

Available information includes:

- PARTS CATALOGS list service parts available for your machine with exploded view illustrations to help you identify the correct parts. It is also useful in assembling and disassembling.
- OPERATOR'S MANUALS providing safety, operating, maintenance, and service information. These manuals and safety signs on your machine may also be available in other languages.
- OPERATOR'S VIDEO TAPES showing highlights of safety, operating, maintenance, and service information. These tapes may be available in multiple languages and formats.
- TECHNICAL MANUALS outlining service information for your machine. Included are specifications, illustrated assembly and disassembly procedures, hydraulic oil flow diagrams, and wiring diagrams. Some products have separate manuals for repair and diagnostic information. Some components, such as engines, are available in separate component technical manuals
- FUNDAMENTAL MANUALS detailing basic information regardless of manufacturer:
  - Agricultural Primer series covers technology in farming and ranching, featuring subjects like computers, the Internet, and precision farming.
  - Farm Business Management series examines "real-world" problems and offers practical solutions in the areas of marketing, financing, equipment selection, and compliance.
  - Fundamentals of Services manuals show you how to repair and maintain off-road equipment.
  - Fundamentals of Machine Operation manuals explain machine capacities and adjustments, how to improve machine performance, and how to eliminate unnecessary field operations.

TS189 —UN—17JAN89

TS191 —UN—02DEC88

TS224 —UN—17JAN89

TS1663 —UN—10OCT97

DX,SERVLIT -19-31JUL03-1/1

John Deere Service Keeps You on The Job

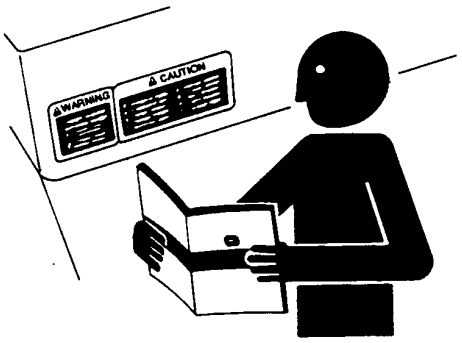
John Deere Is At Your Service

CUSTOMER SATISFACTION is important to John Deere.

Our dealers strive to provide you with prompt, efficient parts and service:

–Maintenance and service parts to support your equipment.

–Trained service technicians and the necessary diagnostic and repair tools to service your equipment.



TS201—UN—23AUG88

CUSTOMER SATISFACTION PROBLEM RESOLUTION PROCESS

Your John Deere dealer is dedicated to supporting your equipment and resolving any problem you may experience.

1. When contacting your dealer, be prepared with the following information:

–Machine model and product identification number

–Date of purchase

–Nature of problem

2. Discuss problem with dealer service manager.

3. If unable to resolve, explain problem to dealership manager and request assistance.

4. If you have a persistent problem your dealership is unable to resolve, ask your dealer to contact John Deere for assistance. Or contact the Ag Customer Assistance Center at 1-866-99DEERE (866-993-3373) or e-mail us at www.deere.com/en_US/ag/contactus/.

DX,IBC,2 -19-02APR02-1/1